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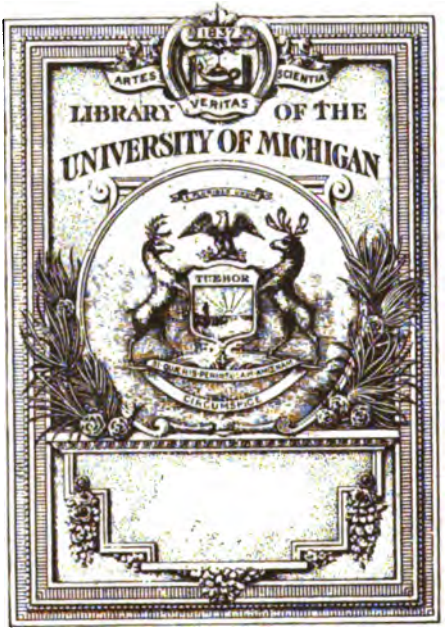

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The Geological Survey

OF

Arkansas.

1907-1923

Water Powers of Arkansas

A Preliminary Report on White River and Some of Its Tributaries.

By

W. N. GLADSON

Engineer in Charge of Water Power Investigations.

A. H. PURDUE,
State Geologist.

1911

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LETTER OF TRANSMITTAL.

To the President, Governor George W. Donaghey, and Members of the Geological Commission of Arkansas:

GENTLEMEN: I have the honor to submit herewith, a preliminary report on the water powers of White River and some of its tributaries.

A. H. PURDUE,
State Geologist.

University of Arkansas,
Fayetteville, Ark.
February 7, 1911.

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THE GEOLOGICAL COMMISSION.

HIS EXCELLENCY, GEORGE W. DONAGHEY,
Governor of Arkansas.

JOHN N. TILLMAN,
President, University of Arkansas.

HON. FRED H. PHILLIPS,
Commissioner of Mines, Manufactures and Agriculture.

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PREFACE.

The rapid consumption of such coal and other stored fuel deposits as are within convenient reach of our commercial centers is a matter of great concern to those who contemplate future conditions. After these deposits shall have been exhausted, where shall posterity turn for heat, light and other power? The utilization of the sun's heat, the energy of the tides or that of the winds for the purposes named, does not now appear practicable. The only known available energy that can in any appreciable measure take the place of the stored fuels is water power. It follows that the amount of such power within the bounds of any state becomes a matter of public concern.

The report that follows covers only White River from its head waters to Buffalo Shoals, a part of North Fork of White River, and Buffalo Fork of White River.

The work for the report was intrusted to W. N. Gladson, Professor of Electrical Engineering in the University of Arkansas. Inasmuch as Professor Gladson has had training in both civil and electrical engineering, he was peculiarly fitted for the undertaking.

It will be seen by the careful reader that while a large amount of water power is available along the streams included in this report, the inauguration of any large enterprise will necessitate the construction of a series of dams and the utilization of the combined power from all; but as the valleys are narrow and but little agricultural land would be flooded by such dams, the cost of developing the power would not be prohibitive.

As the slopes of the drainage basins are steep, the run-off is rapid. The streams, as a result, are subject to sudden freshets, which for the time may increase or reduce the available power, depending upon whether the fall at the dams is increased or diminished. This could be largely, if not entirely, controlled, by constructing a system of dams near the head waters of the streams at such points as to collect the surplus water of excessive rains. Such a system

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would equalize the flow, and thereby reduce the fluctuations of the available water power, at all points. While the present demand for power possibly would not justify the expense necessary for such control, it is quite certain that the future demand will make it imperative.

The fact that this report is only preliminary should be kept in mind by those who make use of the information herein contained. The stream gaging and flow measurements cover a period of only fourteen months. To be wholly reliable they should cover several years; but the frequent requests that come to the State Geologist for information concerning the water power of those streams herein considered, supply the reason for the publication of such data as are at hand.

A. H. PURDUE,
State Geologist.

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Water Powers of Arkansas.

PRELIMINARY REPORT

By

W. N. GLADSON.

INTRODUCTION.

Prior to the beginning of the work covered by this report, no systematic effort had been made to determine and locate the available water powers of the State of Arkansas. Private surveys have been made at a number of points along White River and its tributaries, on the Ouachita and Little Missouri, and on other streams. The data secured by these surveys, however, are not available.

The only river survey work of importance done in the section of the State covered by this report, prior to 1909, was a navigation survey made by the United States Engineer Corps in 1888. This survey covered a portion of White River from Forsythe, Mo., to the mouth, and is recorded on a map of 42 sheets on a scale of one inch to 2,400 feet. In 1909, the Pike County Water Power Company, of Little Rock, Ark., had a survey and estimate made of the water power of a portion of Little Missouri River, at a point near Murfreesboro, Ark. According to the prospectus issued, this survey showed that there was available a minimum of 5,000 horsepower for nine months in the year, and 2,500 horsepower during the month of lowest water, as shown by a record of 39 years.

The United States Bureau of the Census in 1908 made an inquiry into the developed water power of the United States and published the result of the investigation in *Water Supply Paper,* No. 234, United States Geological Survey. In this paper, page 32, Arkansas is credited with having 255 water wheels capable of developing a total maxi-

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mum of 5,868 horsepower, or an average maximum capacity of 23 horsepower per wheel. From these figures it will be understood that no serious attempt has as yet been made to develop Arkansas water power on a large scale.

With the present state of development of the art of transmitting electric power long distances with slight losses, the water power of the northern and western parts of the State should furnish cheap and abundant power in any quarter of the State for manufacturing and lighting purposes. The water power of the mountainous sections of the State can be utilized for driving cotton factories or other manufacturing plants, and for lighting cities, towns, and villages. A water power plant located on White River at Buffalo City, for instance, could economically furnish electric power within a radius of 200 miles, which would reach the most distant point in the State.

The Federal Government exercises the right of sovereignty over navigable streams, and no water power development which will obstruct navigation may be undertaken on such streams without authority from Congress.

The following streams in Arkansas from examinations made by the United States Government seem to be navigable:

Table of navigable streams.

River	Limit of Navigation	Date of Project
White	Buffalo Shoal	1899
St. Francis	Kennett	1884
Red	Fulton	1907
Current	Above State Line	1872
Rlack	Above State Line	1880
Cache	Riverside	1888
Saline	Turtle Bar	....

The water power investigation covered by this report was authorized by the State Legislature of 1909. Work was begun June 28, 1909, on upper White River. The portion of the river within the state from a point near the

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post office at Habberton to Buffalo City and the part of North Fork of White River between Smith's Ferry, near Henderson, and the mouth, were surveyed and mapped. Gaging stations for determining fluctuation of the water surface were established by the United States Geological Survey, at Beaver, Bradley's Ferry, Cotter and Henderson, Ark., and at Branson, Mo. Gage readers were employed to make daily observations of the river hight. Cross sections were made, and flow measurements taken at several stages of the river.

The intention of the survey was to locate by section, township and range, with as much accuracy as was practicable, the principal water power sites.

For the purpose of determining the fall, and of mapping the stream and immediate banks, a plane-table survey was made. The mapping was done on a scale of 1,000 feet to the inch, with contour intervals of 10 feet on land, and 5 feet on the water surface. The meander line of the stream was frequently checked on section corners, while the elevations were checked against United States Geological Survey bench marks. The party spent 63 working days in the field and covered about 250 miles of river, in 1909.

In 1910, the field work was resumed, beginning on Buffalo Fork of White River. This stream was mapped from Boxley to the mouth of the river, using the methods of the summer before.

One gaging station is located on this river at Gilbert, Ark., at which daily observations of river hights are made. On account of the very limited appropriation, the party spent only 26 working days in the field, and mapped about 130 miles of river.

There are 11 sheets of White River, 2 of North Fork, and 9 of Buffalo Fork. These maps were made on the scale of one inch to 1,000 feet, but are reduced one-half, making the scale on which they are published, 1:24000.

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EXPLANATION OF TERMS, TABLES AND CURVES.

Second-foot. A second-foot is the quantity of water flowing past a given point in one second, in a channel one foot wide and one foot deep at the velocity of one foot per second. It equals 7.48 U. S. gallons per second.

Second-foot per square mile. A second-foot per square mile is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly over area and time.

Run-off in inches. The run-off in inches is the depth to which the drainage area would be covered if all the water that flows from it in a given time were uniformly distributed over the area.

Acre-foot. An acre-foot is equal to 43,500 cubic feet, or the quantity of water required to cover one acre one foot deep.

Tables of daily gage hights. The tables of daily gage hights give the daily fluctuations of water surface at each station above the zero of the gage. Most of our stations are read twice a day, morning and evening, and the average hight is given in the following tables.

Tables of discharge measurements. The tables of discharge measurements give the discharge of the river in second-feet, the area of cross section, width, mean velocity, and gage hight on a number of dates when measurements were made.

Rating tables. The rating tables have been calculated from the information obtained from discharge measurements and gage hights. From these tables, one may find the approximate discharge of the river corresponding to a given gage hight. The tables of monthly discharge give general information as to the flow at each station. Under the heading "mean," the average discharge in second-feet for each month is given; under "minimum," the average

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discharge in second-feet for the day of the month when the gage read the lowest; and under the heading "maximum," the average discharge in second-feet for the day of the month when the gage read the highest. Similarly, the maximum, mean and minimum are given for the whole year. The run-off, depth in inches on drainage area, and total acre-feet, are computed from the discharge data.

Rating curve. A rating curve is a curve obtained by plotting gage hights as ordinates and corresponding discharges in second-feet as abscissæ. When a sufficient number of discharge measurements have been made to thoroughly define a "rating curve," the discharge at any gage hight may be estimated from the curve. A rating table is obtained from the curve by estimating the flow in second-feet for all gage hights.

Hydrograph. Daily gage hights at a gaging station, when plotted as ordinates against time as abscissæ, give a line which shows the fluctuations of the water surfaces from day to day, throughout the year. Such a curve is known as a "hydrograph."

In calculating available horsepower in this report, an efficiency of 80 per cent in the water wheel has been assumed, and the following formula has been used:

$$\text{Net horsepower on wheel of 80 per cent efficiency} = \frac{\text{Second-feet} \times \text{fall in feet}}{11}$$

CONVENIENT EQUIVALENTS.

One second-foot equals 7.48 U. S. gallons per second, equals 448.8 gallons per minute, equals 646,272 gallons per day.

One second-foot for one year covers one square mile 13,572 inches deep and equals 31,536,000 cubic feet.

One second-foot for one day covers one square mile 0.03719 inches deep.

One second-foot for 30 days equals 59.50 acre-feet.

One hundred U. S. gallons per minute equals 0.223 second-feet.

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One hundred U. S. gallons per minute for one day equals 0.442 acre-feet.

One million U. S. gallons per day equals 1.55 second-feet.

One million U. S. gallons equals 3.07 acre-feet.

One million cubic feet equals 22.95 acre-feet.

One acre-foot equals 325,828 gallons.

One inch deep on one square mile equals 0.0737 second-feet per year.

One inch deep on one square mile equals 2,323,200 cubic feet.

One acre equals (nearly) 209 feet square.

One horsepower equals 550 foot-pounds per second.

One horsepower equals 746 watts.

One horsepower equals .746 kilowatts.

One horsepower equals one second-foot of water falling 8.8 feet.

One kilowatt equals (about) 1⅓ horsepower.

One kilowatt equals 44,257 foot-pounds per minute.

Pounds per square inch equals 0.434 times the head of water in feet.

Head of water in feet equals 2.3 times pounds per square inch.

One cubic foot of water weighs 62.4 pounds.

One U. S. gallon of water weighs 8.33 pounds.

Horsepower of waterfall equals 62.4 times velocity of flow in feet per minute (V), times head of fall in feet (H), times area of cross section in square feet of stream flowing over fall (A), divided by 33,000. This is expressed in the following formula:

$$\text{H. P.} = \frac{62.4 \times V \times H \times A}{33{,}000}$$

ACCURACY OF FIELD DATA.

In the surveys covered by this report, the location of the streams with reference to section lines, and elevation

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of water surface, with reference to bench marks, is believed to be accurate within two per cent.

Fortunately, the work was begun in a very dry year, and therefore the minimum flow of the streams is probably recorded. The flow measurements, while probably recording the minimum flow, have not included the maximum, nor are there sufficient measurements of flow at any one gaging station to thoroughly define a rating curve. The estimates of daily and monthly flow, on which all power calculations are based, are therefore only first approximations, and should be considered only as estimates of probable power. To get accurate results, the gaging stations should be maintained for a period of from seven to thirteen years. This would give the maximum and minimum gage hights. The flow measurements should be continued as stages of the rivers offer opportunity to get additional points on the rating curves. The data thus secured should be preserved, plotted, and kept on file in some public office where it could be consulted.

The United States Weather Bureau maintains stations at various points in the State, from which reliable data concerning the precipitation and temperature can be obtained. A study of these data, together with the run-off from rivers, would give valuable information.

TOPOGRAPHY AND GEOLOGY OF THE REGION.*

The streams herein considered are in the physiographic division known as the Ozark Plateau. The southern and highest part of this plateau is known as the Boston Mountains. It is on the north slope of these mountains that White River, Buffalo Fork of White River, and many of their tributaries take their rise. While a good portion of these streams and their tributaries are on a lower part of the plateau to the north, all parts run through a broken region.

Those parts of the valleys that are in the Boston Mountain area are deep and canyon-like. The parts to the north of the Boston Mountains are more open, yet they are so narrow that only a small amount of ground is covered dur-

*By A. H. Purdue, State Geologist.

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ing the highest freshets. The bluffs on the outside of the bends are all high and many are precipitous; the slopes on the inside are gradual, though most are steep. The land immediately bordering most parts of the streams is unfit for agriculture and such as is suitable for that purpose lies in narrow strips between the streams and the bordering highland.

North Fork of White River rises in southern Missouri and flows through a narrow valley with steep banks. But little agricultural land along it would be overflowed by such dams as would be required to develop its water power.

The rocks of the region are limestone, sandstone and shale, in horizontal beds. The streams have cut down through these rocks, and in this way the valleys were produced. The stream beds consist of mud, sand, gravel or rock, depending upon whether the velocity of the stream along the reach is slow or swift. At such points as it would be desirable to construct dams for power purposes, if solid rock is not at the surface, it is only a few feet below.

WHITE RIVER AND TRIBUTARIES.

White River rises in the Boston Mountains near the western border of the State and flows in a northeasterly direction, entering Missouri from Carroll County. It reenters Arkansas in Boone County and takes a southeasterly direction, uniting with the Arkansas River near the Mississippi River. The total drainage area above Buffalo City is about 4,911 square miles.

Buffalo Fork of White River rises in the western part of Newton County and empties into White River a few miles below Buffalo City in Marion County. It is about 140 miles long and drains an area of 1,383 square miles.

North Fork of White River empties into White River at Norfork. It drains an area of about 1,642 square miles in Missouri and Arkansas, and is about 70 miles long. Approximately, one-half of its length is in Arkansas.

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UPPER WHITE RIVER.

The tributaries that empty into upper White River from the left are:

1. West Fork,
2. Middle Fork,
3. Prairie Creek,
4. Indian Creek,
5. Spider Creek,
6. Butler Creek,
7. James River,
8. Bull Creek,
9. Swan Creek,
10. Beaver Creek,
11. Shoal Creek,
12. Big Creek,
13. Little North Fork,
14. Spring Creek,
15. Sisters Creek,
16. Howard Creek.

The tributaries that empty into upper White River from the right are:

1. Richland Creek,
2. Brush Creek,
3. War Eagle,
4. Little Clifty,
5. Big Clifty,
6. Leatherwood,
7. Kings River,
8. Indian Creek,
9. Long Creek,
10. Turkey Creek,
11. Bear Creek,
12. Sugarloaf Creek,
13. Jimmie Creek,
14. Crooked Creek.

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Table of distances and fall on White River.

From	To	Stadia distance in miles	Fall in feet.
Habberton	Monte Ne	27.69	59.39
Monte Ne	Jennings Ford	21.40	63.37
Jennings Ford	Blue Springs	27.98	71.58
Blue Springs	Beaver railroad bridge	7.00	18.60
Beaver railroad bridge	State line in Carroll County	3.74	8.20
Total		87.71	221.14
Average fall per mile			2.57
State line in Boone County	Bradleys Ferry	21.92	52.24
Bradleys Ferry	Music Creek	17.42	36.15
Music Creek	Dews Ford	21.18	50.46
Dews Ford	Cotter railroad bridge	15.16	38.18
Cotter railroad bridge	Warner Creek, head of Buffalo Shoal	11.09	25.72
Warner Creek, head of Buffalo Shoal	Foot of Buffalo Shoal	1.73	10.52
Total		88.50	213.27
Average fall per mile			2.41

	Square miles.
Approximate area drained by White River at Beaver railroad bridge	1,200
Approximate area drained by White River at Branson, Mo. bridge	2,730
Approximate area drained by White River at Bradleys Ferry, Arkansas	4,512
Approximate area drained by White River at Cotter railroad bridge	4,800
Approximate area drained by White River at Buffalo City	4,911

The principal tributaries that empty into Buffalo Fork of White River from the left are:

1. Cecils Creek,
2. Mill Creek,
3. Wells Creek,
4. Water Creek,
5. Rush Creek,
6. Blue John Creek.

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The tributaries that empty into Buffalo Fork of White River from the right are:

1. Little Buffalo,
2. Big Creek,
3. Cave Creek,
4. Richland Creek,
5. Calf Creek,
6. Bear Creek,
7. Big Creek,
8. Leatherwood Creek.

Table of distances and fall on Buffalo Fork of White River.

From	To	Stadia distance in miles	Fall in feet
Boxley, Sec. 10, T. 15 N., R. 23 W.	Mouth of Cecils Creek	20.55	229.66
Mouth of Cecils Creek	Mouth of Little Buffalo	12.03	94.29
Mouth of Little Buffalo	Mouth of Richland Creek	22.71	96.98
Mouth of Richland Creek	Gilbert, Mo. & N. Ark. railroad bridge (U. S. G. S. gaging station)	23.00	102.22
Gilbert, Mo. & N. Ark. railroad bridge (U. S. G. S. gaging station	West side of Horseshoe Bend	25.81	83.26
West side of Horseshoe Bend	East side of Horseshoe Bend	7.08	20.82
East side of Horseshoe Bend	Mouth of Buffalo Fork of White River	19.42	58.95
Total		131.00	686.18

Average fall per mile from Boxley to mouth of Buffalo Fork of White River 5.23

Approximate area drained by Buffalo Fork of White River at Mo. & N. Ark. railroad bridge near Gilbert (U. S. G. S. gaging station), square miles 822

At mouth of river 1,383

The principal tributaries that empty into North Fork of White River from the left are Otter Creek, Big Creek, and Bennetts Creek; from the right, Fall Creek and Pigeon Creek.

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Table of distances and fall on North Fork of White River.

From	To	Stadia distance in miles	Fall in feet
Smiths Ferry	Buzzards Roost Falls	4.75	21.68
Buzzards Roost Falls	Mo. & N. Ark. railroad bridge at Norfork	13.95	57.28
Total		18.60	78.96

Average fall per mile..... 4.24
Approximate area drained by North Fork at Smiths Ferry, 898 sq. mi.
Approximate area drained by North Fork at Norfork.....1,642 sq. mi.

Elevations of water surface of White River, Arkansas, above sea level at Gulf, from near Habberton to the State line. —Continued.

Distance Feet	Difference in elevation. Feet	Corrected elevation. Water surface	Remarks.
		1,242.00	U. S. G. S. B. M., near Haberton; datum, Fayetteville.
.....	.....	1,103.04	Low water surface at Oxford Ford.
10,750	1.49	1,101.55	Fayetteville-Goshen wagon bridge.
6,500	2.67	1,098.88	
18,500	11.53	1,087.35	
44,000	18.25	1,069.10	Blands Ferry. Checked on U. S. G. S. B. M. Elevation 1,399; datum, Fayetteville.
17,000	7.24	1,061.86	Near mouth of War Eagle Creek.
15,500	10.46	1,051.40	Mouth of Hickory Creek.
34,000	7.75	1,043.65	Near Monte Ne.
11,000	11.54	1,032.11	Horseshoe Bend.
23,000	11.09	1,021.02	Disneys Ferry. Checked on U. S. G. S. B. M. Elevation 1,064; datum, Fayetteville.
25,000	12.44	1,008.58	Mouth of Prairie Creek. 3,000 feet above Fords Creek.
41,000	21.90	986.68	
13,000	6.40	980.28	Jennings Ford.
52,750	22.41	957.87	Knox Ferry. Checked on U. S. G. S. B. M. Elevation 1,016; datum, Fayetteville.
52,745	21.90	935.97	Huffmans Ford.
42,250	27.27	908.70	Blue Springs.

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Elevations of water surface of White River, Arkansas, above sea level at Gulf, from near Habberton to the State line.—Concluded.

Distance Feet	Difference in Elevation. Feet	Corrected elevation. Water surface	Remarks
			Horseshoe Bend.
14,500	7.20		
		901.50	Beaver, Mo. & N. Ark. R. R. bridge.
22,500	11.40		Checked on U. S. G. S. B. M. Elevation 929; datum, Fayetteville.
		890.10	State line.
19,750	8.20		
		881.90	Temporary B. M. about 4,500 feet below State line in Missouri. Cross on sycamore tree about 5 feet above ground, with 16-penny wire nail driven in center. Tree stands on right bank of river about 50 feet from low water.
4,500	2.72		
		884.62	

UPPER WHITE RIVER, NEAR BEAVER, ARK.

A gaging station was established by the Water Resources Branch of the United States Geological Survey, July 17, 1909, at the Missouri & North Arkanas railroad bridge across White River, near Beaver. It is a standard chain gage, the chain being 50.11 feet long to the upper marker, and 30.11 feet long to the lower marker. Bench mark No. 1 is the top of the left up-stream corner of cap stone of right abutment, marked "B. M." in black paint. Elevation, 40.72 feet above zero of the gage. Bench mark No. 2 is the top of the left up-stream corner of up-stream stone bridge seat of middle pier, marked "B. M." with black paint. Elevation, 42.37 feet above zero of the gage. The elevations, above sea-level, of the bench marks have not been determined.

The records of the United States Weather Bureau for periods varying from 15 to 28 years at Mossville, Fayetteville, Rogers and Dodd City show an average annual precipitation of about 48 inches. Assuming this to be the average for the area drained by upper White River, there would be an annual precipitation of 133.8 billion cubic feet on the 1,200 square miles drained by White River, at Beaver, or 4,245.12 second-feet per year. This area has

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steep slopes with no swamp storage. It is well timbered between cultivated fields. Probably about 25 per cent of the entire area is in cultivation.

This portion of the river is very crooked, there being about 87 miles of river between Habberton and the State line, a distance of only 32 miles on a line. The immediate banks are 12 to 15 feet high.

Considerable power may be realized from this section of the stream by building a series of dams ten to twelve feet high at intervals of five or six miles. At each of these dams a suitable turbine and electric generator could be installed, and the energy thus developed collected at a centrally located station where suitable step-up transformers would raise the potential of the electric current to, say 60,000 volts for long distance transmission. Each of these small generating stations could be cheaply constructed. The space required for machinery would be very small, and dam sites are easily found, as the bed of the river is at most points rock. The dams being low, very little farm land would be inundated in ordinary stages of the river. There should also be constructed a number of storage reservoirs higher up the river to hold back the flood water. In the operation of such a chain of stations, one man supplied with a motorcycle could care for several.

This stretch of the river is not navigable, and is not used for floating timber.

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Daily gage hight, in feet, of White River, near Beaver, Arkansas, for part of 1909-1910. *Observer, Reno N. Lowe.—Continued.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	No	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	3.58	3.2	3.05	3.25	3.7
2	.....	.....	.....	.....	.....	.....	.....	3.5	3.2	3.05	3.25	3.7
3	.....	.....	.....	.....	.....	.....	.....	3.5	3.2	3.05	3.25	3.7
4	.....	.....	.....	.....	.....	.....	.....	3.5	3.2	3.05	3.25	3.72
5	.....	.....	.....	.....	.....	.....	.....	3.5	3.2	3.05	3.55	6.37
6	.....	.....	.....	.....	.....	.....	.....	3.48	3.25	3.05	4.4	8.85
7	.....	.....	.....	.....	.....	.....	.....	3.42	3.25	3.05	3.85	7.35
8	.....	.....	.....	.....	.....	.....	.....	3.4	3.25	3.05	4.25	6.12
9	.....	.....	.....	.....	.....	.....	.....	3.4	3.2	3.25	4.2	5.57
10	.....	.....	.....	.....	.....	.....	.....	3.4	3.18	3.25	4.0	5.2
11	.....	.....	.....	.....	.....	.....	.....	3.4	3.18	3.2	3.8	4.97
12	.....	.....	.....	.....	.....	.....	.....	3.4	3.18	3.15	3.7	4.82
13	.....	.....	.....	.....	.....	.....	.....	3.35	3.18	3.15	3.65	4.7
14	.....	.....	.....	.....	.....	.....	.....	3.35	3.2	3.25	3.65	4.7
15	.....	.....	.....	.....	.....	.....	.....	3.3	3.18	3.15	3.6	4.65
16	.....	.....	.....	.....	.....	.....	.....	3.3	3.15	3.15	3.85	4.6
17	.....	.....	.....	.....	.....	.....	.....	3.3	3.1	3.15	4.1	4.53
18	.....	.....	.....	.....	.....	.....	4.20	3.3	3.1	3.15	4.25	4.45
19	.....	.....	.....	.....	.....	.....	4.05	3.3	3.1	3.2	4.7	4.35
20	.....	.....	.....	.....	.....	.....	4.00	3.30	3.1	3.25	4.55	4.3
21	.....	.....	.....	.....	.....	.....	3.9	3.25	3.12	3.3	4.35	4.3
22	.....	.....	.....	.....	.....	.....	3.9	3.22	3.15	3.45	4.15	4.22
23	.....	.....	.....	.....	.....	.....	3.8	3.2	3.12	3.45	4.07	4.22
24	.....	.....	.....	.....	.....	.....	3.8	3.2	3.12	3.4	4.00	4.1
25	.....	.....	.....	.....	.....	.....	3.7	3.2	3.1	3.35	3.9	4.0
26	.....	.....	.....	.....	.....	.....	3.7	3.2	3.1	3.3	3.85	4.05
27	.....	.....	.....	.....	.....	.....	3.7	3.2	3.1	3.25	3.72	4.05
28	.....	.....	.....	.....	.....	.....	3.7	3.2	3.1	3.25	3.7	4.0
29	.....	.....	.....	.....	.....	.....	3.6	3.25	3.1	3.25	3.7	4.0
30	.....	.....	.....	.....	.....	.....	3.6	3.25	3.1	3.25	3.7	4.25
31	.....	.....	.....	.....	.....	.....	3.6	3.22	3.1	3.3	.....	3.9

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Daily gage hight, in feet, of White River, near Beaver, Arkansas, for part of 1909-1910. Observer, Reno N. Lowe.—Concluded.

	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	3.9	4.1	8.15	6.3	4.8	6.1	5.4	4.05	3.7	....	....	....
2	3.8	4.05	6.9	5.55	4.7	5.95	5.1	4.0	3.8	....	....	....
3	3.8	4.0	6.4	5.35	4.6	5.55	4.9	4.0	3.8	....	....	....
4	3.8	4.0	5.95	5.15	4.5	5.35	5.7	3.95	3.85	....	....	....
5	3.8	4.0	5.65	5.25	4.45	5.15	5.35	3.9	3.8	....	....	....
6	3.9	3.9	5.45	5.00	4.4	4.95	5.1	3.9	4.15	....	....	....
7	4.45	3.9	5.27	6.8	4.4	4.9	4.75	4.8	4.3	....	....	....
8	4.5	3.9	5.05	6.35	4.4	5.2	4.75	6.5	4.05	....	....	....
9	4.4	3.9	5.0	6.05	4.4	5.15	4.9	6.4	4.15	....	....	....
10	4.2	3.9	5.05	6.7	4.45	5.65	5.0	5.5	4.15	....	....	....
11	4.15	3.9	4.9	6.45	4.45	5.6	5.55	5.55	4.0	....	....	....
12	4.0	3.8	4.8	6.75	4.35	6.15	11.75	5.15	4.0	....	....	....
13	4.3	3.8	4.75	9.4	4.3	5.9	12.7	5.2	3.9	....	....	....
14	4.45	3.8	4.7	7.6	4.2	5.5	9.8	4.85	3.8	....	....	....
15	4.4	3.8	4.65	7.55	4.25	5.25	7.55	4.7	3.75	....	....	....
16	4.4	3.9	4.55	7.7	6.75	5.05	6.65	4.55	3.7	....	....	....
17	4.4	3.9	4.47	7.8	19.0	4.85	6.1	4.65	3.65	....	....	....
18	4.4	4.0	4.4	7.5	12.4	4.65	5.7	4.5	3.6	....	....	....
19	4.5	4.05	4.4	6.9	9.1	4.55	5.45	4.45	3.6	....	....	....
20	4.4	3.95	4.33	6.5	7.95	4.55	5.25	4.25	3.6	....	....	....
21	4.4	4.35	4.3	6.15	7.2	4.7	5.05	4.2	3.6	....	....	....
22	4.4	4.5	4.25	5.95	6.95	4.6	4.85	4.2	3.6	....	....	....
23	4.4	4.8	4.2	5.75	7.8	4.5	4.75	4.2	3.55	....	....	....
24	4.4	5.0	4.2	5.55	8.4	4.65	4.65	4.15	3.5	....	....	....
25	4.3	5.17	4.2	5.45	8.4	4.55	4.5	4.05	3.5	....	....	....
26	4.3	5.35	4.1	5.25	7.8	5.05	4.4	4.0	3.5	....	....	....
27	4.25	6.4	4.1	5.1	7.0	5.05	4.35	3.9	3.5	....	....	....
28	4.2	7.9	4.1	5.0	6.5	6.0	4.25	3.85	4.3	....	....	....
29	4.1	.....	4.05	4.95	6.05	6.75	4.15	3.8	4.2	....	....	....
30	4.1	.....	4.35	4.8	5.75	5.75	4.2	3.8	3.95	....	....	....
31	4.1	.....	5.4	....	5.55	....	4.15	3.75	....	....	....	....

Discharge measurements of White River at Beaver, Arkansas.

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 3	W. N. Gladson	75	148	0.61	3.5	91*
Nov. 20	W. N. Gladson	110	497	0.80	4.55	899*
Dec. 17	W. N. Gladson	105	469	0.92	4.5	431*
1910						
May 24	W. N. Gladson	182	1324	2.39	8.61	3,618*

Remarks.

*1,000 ft. above bridge.

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Rating table for White River at Mo. & N. Ark. R. R. bridge, near Beaver, Ark., from July 18, 1909, to October 1, 1910.—Continued.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
3.00	40	5	5.50	986	70	8.00	3080	89
3.10	45	8	5.60	1056	72	8.10	3169	89
3.20	53	10	5.70	1128	73	8.20	3258	89
3.30	63	13	5.80	1201	74	8.30	3347	89
3.40	76	15	5.90	1275	75	8.40	3436	89
3.50	91	17	6.00	1350	77	8.50	3525	89
3.60	108	20	6.10	1427	79	8.60	3614	89
3.70	128	24	6.20	1506	81	8.70	3703	89
3.80	152	28	6.30	1587	82	8.80	3792	89
3.90	180	30	6.40	1669	63	8.90	3881	89
4.00	210	32	6.50	1752	85	9.00	3970	89
4.10	242	36	6.60	1837	87	9.10	4059	89
4.20	278	40	6.70	1924	88	9.20	4148	89
4.30	318	44	6.80	2012	89	9.30	4237	89
4.40	362	48	6.90	2101	89	9.40	4326	89
4.50	410	50	7.00	2190	89	9.50	4415	89
4.60	460	51	7.10	2279	89	9.60	4504	89
4.70	511	52	7.20	2368	89	9.70	4593	89
4.80	563	53	7.30	2457	89	9.80	4682	89
4.90	616	54	7.40	2546	89	9.90	4771	89
5.00	670	57	7.50	2635	89	10.00	4860	89
5.10	727	60	7.60	2724	89	10.10	4949	89
5.20	787	64	7.70	2813	89	10.20	5038	89
5.30	851	66	7.80	2902	89	10.30	5127	89
5.40	917	69	7.90	2991	89	10.40	5216	89

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Rating table for White River at Mo. & N. Ark. R. R. bridge, near Beaver, Ark., from July 18, 1909, to October 1, 1910.—Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
10.50	5305		11.30	6017		12.10	6729	
		89			89			89
10.60	5394		11.40	6106		12.20	6818	
		89			89			89
10.70	5483		11.50	6195		12.30	6907	
		89			89			89
10.80	5572		11.60	6284		12.40	6996	
		89			89			89
10.90	5661		11.70	6373		12.50	7085	
		89			89			89
11.00	5750		11.80	6462		12.60	7174	
		89			89			89
11.10	5839		11.90	6551		12.70	7263	
		89			89			89
11.20	5928		12.00	6640		12.80	7352	
		89			89			89
						12.90	7441	
								89

The above table is not applicable for ice or obstructed channel conditions. It is based on four discharge measurements made during August, November, and December, 1909, and May, 1910, and is not well defined. Above gage hight 7 feet the rating curve is a tangent, the difference being 89 per tenth.

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Monthly discharge of White River, near Beaver, Arkansas, for 1909-1910. (Drainage area, 1,200 square miles.)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	108	53	70	.058	.066
September	63	45	51	.043	.048
October	91	45	58	.048	.055
November	511	63	201	.167	.186
December	3,881	128	596	.496	.571
The period	3,881	45	195	.160	.904
1910					
January	410	152	299	.249	.287
February	2,991	152	435	.362	.376
March	3,258	242	698	.581	.669
April	4,326	563	1,607	1.33	1.48
May	12,870	278	1,928	1.61	1.85
June	2,012	410	878	.731	.815
July	7,263	278	1,311	1.01	1.16
August	1,752	152	466	.388	.447
September	318	91	171	.142	.158
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The period	12,870	91	866	.721	7.33

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Temporary bench mark, 16-penny wire nail in cross on sycamore tree. Tree stands on right bank of river in Taney County, Missouri, about 100 feet above mouth of Bear Creek and 20 feet from low water. Elevation 612.19 feet.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
1,640	.08	500.00	596.61	Assumed elevation of water surface at mouth of Bear Creek about State line.
1,384	.60	499.92	596.53	
1,692	1.10	499.32	595.93	
1,752	1.80	498.22	594.83	
1,556	.08	496.42	593.03	
2,140	1.30	496.34	592.95	
1,754	.18	495.04	591.65	
3,218	1.71	494.86	691.47	
3,590	1.81	493.15	589.76	South end of Grays Bend.
1,504	.58	491.34	587.95	
1,460	.74	490.76	587.37	West side of Horseshoe Bend.
1,916	.12	490.02	586.63	
1,824	1.04	489.90	586.51	
1,932	.90	488.86	585.47	
1,652	.60	487.96	584.57	
1,724	.40	487.36	583.97	
3,580	1.54	486.96	583.57	
1,240	.68	485.42	582.03	

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		484.74	581.35	
1,684	1.24	483.50	580.11	
1,276	.10	483.40	580.01	
2,182	2.19	481.21	577.82	
2,320	1.50	479.71	576.32	
1,700	.02	479.69	576.30	
4,292	2.68	477.01	573.62	
1,668	.02	476.99	573.60	
1,712	.86	476.13	572.74	
2,380	1.55	474.58	571.19	
1,328	.24	474.34	570.95	East side of Horseshoe Bend, fall of 14.52 ft. across bend.
1,276	.20	474.14	570.75	
1,292	.04	474.10	570.71	
1,960	2.10	472.00	568.61	
3,412	.20	471.80	568.41	
1,600	.00	471.80	568.41	
1,436	.14	471.66	568.27	
1,736	1.78	469.88	566.49	
3,878	.09	469.79	566.40	
1,292	1.46	468.33	564.94	
1,424	1.44	466.89	563.50	
1,800	1.50	465.39	562.00	
1,604	.08			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		465.31	561.92	
1,212	.00			
		465.31	561.92	
2,132	1.62			
		463.69	560.30	
3,896	.86			
		462.83	559.44	
2,940	2.34			
		460.49	557.10	Mouth of West Sugarloaf Creek.
1,504	1.04			
		459.45	556.06	
2,464	1.38			
		458.07	554.68	
2,320	92			
		457.15	553.76	
1,962	1.34			
		455.81	552.42	
3,676	2.00			
		453.81	550.42	
4,328	.16			
		453.65	550.26	
6,848	.44			
		453.21	549.82	Holts Ferry.
1,938	2.97			
		450.24	546.85	
1,708	.14			
		450.10	546.71	
2,976	2.34			
		447.76	544.37	Bradleys Ferry.
2,368	.02			
		447.74	544.35	
2,072	1.16			
		446.58	543.19	
1,416	.66			
		445.92	552.53	
1,868	.12			
		445.80	552.41	
1,520	.10			
		445.70	542.31	
1,716	1.92			
		443.78	540.39	
1,880	2.30			
		441.48	538.09	
2,580	.30			
		441.18	537.79	
1,872	.38			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		440.80	537.41	
3,644	1.70	439.10	535.71	Keesee Ferry.
2,480	.40	438.70	535.51	
4,238	.84	437.86	534.47	
2,712	1.74	436.12	532.73	
2,036	1.40	434.72	531.33	
2,624	.86	433.86	530.47	North end of bend, in Missouri.
2,480	.10	433.76	530.37	
1,940	.82	432.94	529.55	
2,584	.90	432.04	528.65	
2,076	.20	431.84	528.45	
2,120	.60	431.24	527.85	
2,264	.28	430.96	527.57	
2,872	1.86	249.10	525.71	
2,160	.28	428.82	525.43	
1,892	2.70	426.12	522.73	
2,760	2.90	423.22	519.83	Mouth of Big Creek.
2,720	.80	422.42	519.03	
2,880	.70	421.72	518.33	
2,464	.13	421.59	518.20	
2,292	2.00	419.59	516.20	
1,304	1.40	418.19	514.80	
1,808	.20	417.99	514.60	
2,168	.24			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		417.75	514.36	
2,024	.30	417.45	514.06	
2,292	.24	417.21	513.82	
2,548	.04	417.17	513.78	
2,290	.70	416.47	513.08	Upper Bull Shoal.
2,756	4.08	412.39	509.00	
1,832	.14	412.25	508.86	
1,604	.20	412.05	508.66	
2,156	.24	411.81	508.42	
1,952	.10	411.71	508.32	
1,680	.10	411.61	508.22	Mouth of Big Music Creek.
1,844	1.26	410.35	506.96	
1,628	2.46	407.89	504.50	
2,356	1.42	406.47	503.08	
2,576	.10	406.37	502.98	
2,844	.08	406.29	502.90	Pot Shoal.
2,266	3.06	403.23	499.82	
2,184	.32	402.91	499.52	
1,900	.42	402.49	499.10	
2,764	.58	401.91	498.52	
2,620	.50	401.41	498.02	
2,456	.10	401.31	497.92	
2,056	.90	400.41	497.02	
2,480	.70			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		399.71	496.32	
1,768	.46			
		399.25	495.86	
1,788	.56			
		398.69	495.30	Upper end of McGar Shoal; 5.8 ft. fall in 2,700 ft.
1,400	2.40			
		396.29	492.90	
1,800	3.40			
		392.89	489.50	
1,778	.38			
		392.51	489.12	
1,746	1.52			
		390.99	487.60	
3,200	.12			
		390.87	487.48.	
1,776	1.48			
		389.39	486.00	
2,492	.40			
		388.99	485.60	
1,924	1.36			
		387.63	484.24	
2,440	.12			
		387.51	484.12	
2,492	.10			
		387.41	484.02	
2,486	1.18			
		386.23	482.84	
2,760	.08			
		386.15	482.76	
2,248	1.40			
		384.75	481.36	
2,488	.66			
		384.09	480.70	Dry Run Creek.
1,916	.56			
		383.53	480.14	
2,452	1.30			
		382.23	478.84	
3,144	.58			
		381.65	478.26	Mouth of Sister Creek; 5.09 ft. fall in 3,800 ft.
1,936	2.78			
		378.87	475.45	
1,944	2.22			
		376.65	473.26	
3,188	.86			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		375.79	472.40	
2,702	.34			
		375.45	472.06	
2,480	1.80			
		373.65	470.26	
2,084	.40			
		373.25	469.86	
1,864	.82			
		372.43	469.04	
1,232	.28			
		372.15	468.76	
1,446	.06			
		372.09	468.70	
2,068	.04			
		372.05	468.66	
1,988	3.34			
		368.71	465.32	
2,820	.50			
		368.21	464.82	
1,740	.12			
		368.09	464.70	
2,444	.72			
		367.37	463.98	Bull Shoal; 6.07 ft. fall in 6,400 ft.
2,484	3.28			
		364.09	460.70	
2,780	1.40			
		362.69	459.30	
1,642	1.54			
		361.15	457.76	
3,120	.80			
		360.35	456.96	
1,784	.02			
		360.33	456.94	
2,240	.20			
		360.13	456.74	
2,900	2.80			
		357.33	453.94	
2,076	1.36			
		355.97	452.58	
2,370	.10			
		355.87	452.48	
2,420	.60			
		355.27	451.88	Collins Ferry.
2,252	1.32			
		353.95	450.56	
2,660	1.90			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		352.05	448.66	
2,280	.06			
		351.99	448.60	Turkey Butt Mountain Shoal; 2.3 ft. fall in 1,600 ft.
1,792	2.30			
		349.69	446.30	
2,072	1.00			
		348.69	445.30	
2,320	1.60			
		347.09	443.70	
2,184	.16			
		346.93	443.54	
2,648	.16			
		346.77	443.38	Whites Ferry.
2,340	.10			
		346.67	443.28	
2,220	.30			
		346.37	442.98	Shoal; 2.42 ft. fall in 1,700 ft.
1,768	2.42			
		343.95	440.56	
2,364	.82			
		343.63	440.24	
2,464	1.82			
		341.81	438.42	
2,408	.96			
		340.85	437.46	
2,580	.48			
		340.37	436.98	
2,480	1.30			
		339.07	435.68	Wild Cat Shoal; 3.48 ft. fall in 2,800 ft.
2,808	3.48			
		335.59	432.20	
2,864	1.18			
		334.41	431.02	
2,932	.88			
		333.53	430.14	Mooneys Ford.
2,440	.90			
		332.63	429.24	
3,122	.80			
		331.83	428.44	
2,416	.10			
		331.73	428.34	Dentons Ferry.
2,088	3.70			
		328.03	424.64	
2,420	1.40			
		326.63	423.24	
1,684	.72			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		325.91	422.52	
2,324	1.48			
		324.43	421.04	
2,748	1.10			
		323.33	419.94	
1,580	.36			
		322.97	419.58	St. L., I. M. & S. Ry. bridge, at Cotter.
2,040	.20			
		322.77	419.38	
2,032	.38			
		322.39	419.00	
1,884	.18			
		322.21	418.82	Red Bud Shoal; 6.8 ft. fall in 4,600 ft.
2,168	4.60			
		317.61	414.22	
2,448	1.76			
		315.85	412.46	
2,550	.60			
		315.25	411.86	
2,404	.08			
		315.17	411.78	
3,200	.50			
		314.67	411.28	
3,728	.04			
		314.63	411.24	
3,060	.32			
		314.31	410.92	
2,220	2.10			
		312.21	408.82	
2,260	.90			
		311.31	407.92	Crooked Creek or Rim Shoal.
2,240	4.70			
		306.61	403.22	
2,738	1.30			
		305.31	401.92	
2,116	1.70			
		303.61	400.22	Mouth of Crooked Creek.
6,540	1.94			
		301.67	398.28	
2,520	.80			
		300.87	397.48	
3,404	1.82			
		299.05	395.66	
2,900	.60			
		298.45	395.06	
2,960	.80			

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Elevations of water surface of White River, Arkansas, above sea-level at Gulf, from mouth of Bear Creek to foot of Buffalo Shoals.—Concluded.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		298.15	394.76	Buffalo Shoal, 11.78 ft. fall in 2.3 Miles.
3,140	.90			
		297.25	393.86	
2,860	1.40			
		295.85	392.46	
2,438	1.96			
		293.89	390.50	
2,446	5.68			
		288.21	384.82	
1,424	1.48			
		286.78	383.34	
....	....	.....	422.31	U. S. G. S. B. M., monument 5 in. by 5 in. square. Lime stone 5 in. above ground on right bank of river about 500 feet above old landing.
....	....			

Total fall from mouth of Bear Creek to Buffalo City, 213.27 feet.
Total distance.....88.50 miles.
Average fall per mile.....2.41 feet.

WHITE RIVER NEAR BRANSON, MISSOURI.

This gaging station was established by the Water Resources Branch of the United States Geological Survey, July 19, 1909. It is located at the St. Louis, Iron Mountain & Southern Railroad bridge across White River about 600 feet above the mouth of Turkey Creek.

It is a standard chain gage attached to the guard rail of the bridge on the down-stream side. The chain is 54.88 feet from the end of the weight to the upper marker, and 34.88 feet to lower marker. The gage is located from two bench marks. Number 1 is the top of a lag screw driven in the root, on the east side of a hackberry tree at the ferry landing about 400 feet below the bridge on the right side of

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the river. Elevation 20.72 feet above zero of gage. Number 2 is the center of the head of a 20-penny nail, 4.7 feet above the ground, driven horizontally in the south side of an elm tree, which stands about 25 feet east of hackberry tree. Elevation 20.66 feet above zero of gauge. Elevation above sea-level has not been determined.

Daily gage hight, in feet, of White River, near Branson, Missouri, for part of 1909-1910. *Observers, Wm. Kruger and John A. Medley.—Continued.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	3.1	2.55	2.3	2.5	2.85
2	.....	.....	.....	.....	.....	.....	.....	3.0	2.5	2.3	2.5	2.85
3	.....	.....	.....	.....	.....	.....	.....	3.0	2.5	2.3	2.5	2.80
4	.....	.....	.....	.....	.....	.....	.....	3.0	2.48	2.3	2.5	2.93
5	.....	.....	.....	.....	.....	.....	.....	2.95	2.4	2.3	2.45	2.95
6	.....	.....	.....	.....	.....	.....	.....	2.95	2.4	2.3	3.05	6.62
7	.....	.....	.....	.....	.....	.....	.....	2.95	2.4	2.3	3.75	7.05
8	.....	.....	.....	.....	.....	.....	.....	2.98	2.6	2.3	3.6	6.47
9	.....	.....	.....	.....	.....	.....	.....	3.15	2.55	2.4	3.3	4.95
10	.....	.....	.....	.....	.....	.....	.....	3.02	2.55	2.43	3.5	4.45
11	.....	.....	.....	.....	.....	.....	.....	2.95	2.55	2.5	3.4	4.2
12	.....	.....	.....	.....	.....	.....	.....	2.9	2.52	2.5	3.27	4.0
13	.....	.....	.....	.....	.....	.....	.....	2.82	2.45	2.5	3.1	3.82
14	.....	.....	.....	.....	.....	.....	.....	2.75	2.5	2.5	3.1	3.7
15	.....	.....	.....	.....	.....	.....	.....	2.75	2.45	2.5	3.1	3.6
16	.....	.....	.....	.....	.....	.....	.....	2.7	2.45	2.5	3.65	3.55
17	.....	.....	.....	.....	.....	.....	.....	2.65	2.45	2.5	3.73	3.5
18	.....	.....	.....	.....	.....	.....	.....	2.6	2.45	2.5	3.8	3.4
19	.....	.....	.....	.....	.....	.....	4.00	2.6	2.4	2.45	3.7	3.82
20	.....	.....	.....	.....	.....	.....	3.88	2.55	2.4	2.5	3.65	3.22
21	.....	.....	.....	.....	.....	.....	3.75	2.6	2.4	2.5	3.60	3.15
22	.....	.....	.....	.....	.....	.....	3.65	2.6	2.35	2.5	3.4	3.17
23	.....	.....	.....	.....	.....	.....	3.6	2.6	2.35	2.5	3.3	3.33
24	.....	.....	.....	.....	.....	.....	3.48	2.55	2.38	2.5	3.25	3.2
25	.....	.....	.....	.....	.....	.....	3.4	2.6	2.4	2.5	3.1	3.17
26	.....	.....	.....	.....	.....	.....	3.35	2.5	2.4	2.5	3.0	3.05
27	.....	.....	.....	.....	.....	.....	3.3	2.5	2.4	2.5	3.0	3.0
28	.....	.....	.....	.....	.....	.....	3.25	2.5	2.3	2.5	3.0	3.0
29	.....	.....	.....	.....	.....	.....	3.25	2.5	2.3	2.5	2.92	3.0
30	.....	.....	.....	.....	.....	.....	3.2	2.48	2.3	2.5	2.8	2.9
31	.....	.....	.....	.....	.....	.....	3.2	2.45	.....	2.5	.....	3.0

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Daily gage hight, in feet, of White River, near Branson, Missouri, for part of 1909-1910. *Observers, Wm. Kruger and John A. Medley.—Concluded.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	2.95	3.0	7.35	2.6	3.0	4.05	4.2	3.3	2.25	....	....	....
2	2.95	3.0	7.25	4.3	3.05	4.0	4.0	3.2	2.5	....	....	....
3	2.95	3.0	6.75	4.0	2.50	4.10	4.0	3.0	3.15	....	....	....
4	2.9	3.0	5.85	3.85	2.55	4.35	4.25	3.0	3.05	....	....	....
5	3.0	2.9	5.45	3.8	2.4	5.9	4.45	3.0	2.9	....	....	....
6	3.0	2.9	4.6	4.15	2.55	6.05	4.15	2.85	3.6	....	....	....
7	3.0	2.9	3.65	4.15	2.75	5.45	4.45	2.85	3.6	....	....	....
8	3.0	2.85	4.9	4.7	3.05	7.2	4.35	3.45	3.5	....	....	....
9	3.2	2.85	3.4	4.95	3.95	8.9	3.85	5.1	3.3	....	....	....
10	3.2	2.8	3.45	4.85	3.9	10.25	3.55	6.5	3.2	....	....	....
11	3.15	2.8	4.1	4.8	3.35	9.55	4.4	5.6	3.2	....	....	....
12	3.1	2.8	3.7	4.1	2.95	7.9	9.1	4.55	2.95	....	....	....
13	3.15	2.75	3.5	4.15	2.7	6.35	11.8	4.15	2.6	....	....	....
14	3.25	2.7	3.4	6.35	3.0	6.0	9.95	3.9	2.7	....	....	....
15	3.4	2.7	3.4	5.45	2.95	5.3	8.0	3.85	2.55	....	....	....
16	3.5	2.7	3.15	5.10	3.1	4.7	5.95	3.8	2.5	....	....	....
17	4.0	2.7	2.85	5.6	10.6	4.15	5.3	3.7	2.4	....	....	....
18	3.8	2.7	2.8	5.1	15.2	4.15	5.15	3.05	2.5	....	....	....
19	3.65	2.7	2.95	5.2	9.9	3.6	4.25	3.35	2.5	....	....	....
20	3.6	3.15	2.95	4.7	7.55	3.35	4.0	3.6	2.45	....	....	....
21	3.6	3.35	2.9	4.35	6.4	3.5	3.85	3.45	2.4	....	....	....
22	3.5	5.1	2.6	3.9	6.0	3.4	3.75	3.3	2.5	....	....	....
23	3.4	6.35	2.6	3.6	5.4	3.45	3.7	3.15	2.5	....	....	....
24	3.35	5.1	2.45	3.25	5.35	3.35	3.7	3.0	2.5	....	....	....
25	3.35	4.8	2.4	3.4	6.25	3.1	3.95	2.9	2.45	....	....	....
26	3.3	3.45	2.35	3.1	6.7	3.4	3.5	2.9	2.4	....	....	....
27	3.2	5.27	2.53	3.15	6.55	3.5	3.3	2.85	2.65	....	....	....
28	3.2	6.3	2.6	3.0	5.7	3.8.	3.0	2.7	3.0	....	....	....
29	3.2	....	2.5	3.05	5.0	4.75	2.9	2.6	2.85	....	....	....
30	3.15	....	2.4	3.0	4.65	5.05	2.95	2.6	2.6	....	....	....
31	3.0	....	2.27	....	4.3	.....	3.35	2.35	....	....	....	....

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Discharge measurements of White River, near Branson, Missouri,

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Nov. 22	W. N. Gladson	270	946	1.36	3.3	1284*
Dec. 18	W. N. Gladson	268	972	1.14	3.4	1114*
1910						
May 17	W. N. Gladson	375	3157	5.23	10.48	17519†

*500 ft. below bridge.
†At railway bridge.

Rating table for White River at Missouri Pacific Railway bridge, near Branson, Missouri, from July 19, 1909, to October 1, 1910.—Continued.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
2.00	300		3.50	1141		5.00	3000	
		38			73			156
2.10	338		3.60	1214		5.10	3156	
		40			77			157
2.20	378		3.70	1291		5.20	3313	
		42			86			158
2.30	420		3.80	1377		5.30	3471	
		46			98			159
2.40	466		3.90	1475		5.40	3630	
		48			125			165
2.50	514		4.00	1600		5.50	3795	
		50			128			169
2.60	564		4.10	1728		5.60	3964	
		53			130			175
2.70	617		4.20	1858		5.70	4139	
		58			133			184
2.80	675		4.30	1991		5.80	2323	
		60			135			187
2.90	735		4.40	2126		5.90	4510	
		65			138			190
3.00	800		4.50	2264		6.00	4700	
		66			140			195
3.10	866		4.60	2404		6.10	4895	
		67			143			198
2.20	933		4.70	2547		7.20	5093	
		68			147			200
3.30	1001		4.80	2694		6.30	5293	
		69			152			204
3.40	1070		4.90	2846		6.40	5497	
		71			154			206

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Rating table for White River at Missouri Pacific Railway bridge, near Branson, Missouri, from July 19, 1909, to October 1, 1910.—Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
6.50	5708		8.40	10508		10.20	16485	
		208			280			350
6.60	5911		8.50	10788		10.30	16835	
		212			287			350
6.70	6123		8.60	11069		10.40	17185	
		217			290			350
6.80	6340		8.70	11359		10.50	17535	
		225			300			350
6.90	6565		8.80	11659		10.60	17885	
		235			318			350
7.00	6800		8.90	11977		10.70	18235	
		245			323			350
7.10	7045		9.00	12300		10.80	18585	
		247			335			350
7.20	7292		9.10	12635		10.90	18985	
		249			350			350
7.30	7541		9.20	12985		11.00	19285	
		254			350			350
7.40	7795		9.30	13335		11.10	19635	
		260			350			350
7.50	8055		9.40	13685		11.20	19985	
		263			350			350
7.60	8318		9.50	14035		11.30	20335	
		266			350			350
7.70	8584		9.60	14385		11.40	20685	
		269			350			350
7.80	8853		9.70	14735		11.50	21035	
		272			350			350
7.90	9125		9.80	15085		11.60	21385	
		275			350			350
8.00	9400		9.90	15435		11.70	21735	
		276			350			350
8.10	9676		10.00	15785		11.80	22085	
		276			350			350
8.20	9952		10.10	16135		11.90	22435	
		277			350			350
8.30	10229							
		279						

The above table is not applicable for ice or obstructed channel conditions. It is based on three discharge measurements made during November and December, 1909, and May, 1910, and is not well defined. Above gage hight 10 feet the rating curve is a tangent, the difference being 350 per tenth.

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Monthly discharge of White River near Branson, Missouri, for 1909-1910. (Drainage area, 2,730 square miles.)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	933	514	664	.243	.28
September	564	420	493	.180	.20
October	514	420	486	.178	.21
November	1,377	514	860	.315	.35
December	7 045	675	1,584	.580	.67
The period	7045	420	817	.299	1.69
1910					
January	1,377	735	991	.363	.42
February	5,497	617	1,422	.521	.54
March	7,795	420	1,772	.649	.75
April	5,497	564	2,065	.756	.84
May	33,985	466	4,386	1.60	1.84
June	16,835	866	3,935	1.44	1.61
July	22,085	735	3,486	1.27	1.46
August	5,703	564	1,325	.485	.56
September	1,214	420	689	.252	.28
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The period	33,985	420	20,071	.735	.748

WHITE RIVER NEAR LEAD HILL, ARKANSAS.

This gaging station was located October 1, 1909, by the Water Resources Branch of the United States Geological Survey at Bradleys Ferry, about 6 miles northeast from Lead Hill. It is a staff gage in two sections. The first section is nailed to the down-stream side of a sycamore tree about 100 feet below the ferry cable on the right bank. The second section is nailed to an oak tree which stands 8 feet north and 20 feet west of the tree to which the first

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section is nailed. The first section of the gage is located with reference to bench mark No. 1, which is a 40-penny wire nail driven in the sycamore tree, to which it is fastened. Elevation, 6.37 feet above zero of gage. Bench mark No. 2 is a 40-penny wire nail driven in the oak tree to which the second section of the gage is attached. Elevation, 18 feet above zero of the gage. The elevations above sea-level have not been established.

Daily gage hight, in feet, of White River, at Bradleys Ferry, Arkansas, for part of 1909-1910.
Observer, Jerry Upshaw.—Continued.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.8	1.8
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.3	1.7
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.3	1.8
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.3	1.8
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.3	4.15
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	3.5	5.8
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	1.85	5.6
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.1	2.6	6.0
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.45	2.3	4.9
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.2	4.1
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.4	3.55
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.25	2.3	3.45
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.25	2.1	3.2
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.0	3.1
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.0	3.1
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.0	2.8
17	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.5	2.7
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.7	2.6
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.8	2.5
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	2.55	2.4
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.6	2.3
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.5	2.0
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.4	2.0
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.2	2.1
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.1	2.0
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	2.0	1.8
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	1.9	1.7
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	1.8	1.7
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	1.8	1.6
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2	1.7	1.6
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	.....	2.0

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Daily gage hight, in feet, of White River, at Bradleys Ferry, Arkansas, for part of 1909-1910.
Observer, Jerry Upshaw.—Concluded.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	1.9	2.0	6.4	2.25	2.6	3.7	3.9	2.7	1.7	....	....	....
2	1.9	2.0	6.8	2.6	2.5	3.6	3.6	2.5	2.0	....	....	....
3	1.8	1.9	6.1	3.2	2.4	3.4	3.15	2.3	2.3	....	....	....
4	1.7	1.9	5.35	3.0	2.3	3.2	3.2	2.2	2.7	....	....	....
5	1.8	1.9	4.8	3.0	2.2	3.85	3.55	2.1	2.5	....	....	....
6	1.4	1.9	4.45	3.6	2.2	4.85	3.45	2.0	2.95	....	....	....
7	1.8	1.8	4.05	4.0	2.3	4.8	3.35	2.0	3.3	....	....	....
8	1.8	1.8	3.8	4.1	2.3	4.95	3.25	2.0	3.0	....	....	....
9	1.9	1.8	3.6	4.45	3.2	7.7	3.1	5.65	2.8	....	....	....
10	1.9	1.7	3.7	4.2	3.45	9.7	3.1	6.75	2.7	....	....	....
11	2.2	1.7	4.4	4.0	3.3	9.8	3.05	5.75	2.6	....	....	....
12	2.0	1.7	4.25	4.05	3.1	7.45	9.4	4.75	2.45	....	....	....
13	2.0	1.7	4.0	4.0	3.0	5.85	10.3	3.95	2.25	....	....	....
14	2.0	1.7	3.9	4.65	2.8	5.55	10.75	3.65	2.2	....	....	....
15	2.55	1.6	3.75	5.05	2.6	4.7	8.5	3.6	2.1	....	....	....
16	2.9	1.6	3.55	4.6	2.85	4.2	6.35	3.3	2.0	....	....	....
17	3.1	1.6	3.44	4.75	5.2	4.0	5.75	3.1	1.9	....	....	....
18	3.1	1.6	3.15	4.8	13.2	3.7	5.7	3.55	1.8	....	....	....
19	2.9	1.6	3.0	4.7	12.5	3.45	4.75	3.3	1.8	....	....	....
20	2.8	1.7	2.9	4.6	7.5	3.2	4.1	3.05	1.7	....	....	....
21	2.7	2.0	2.8	4.25	6.65	3.1	3.65	2.8	1.7	....	....	....
22	2.6	2.45	2.7	3.95	5.3	3.0	3.3	2.95	1.6	....	....	....
23	2.6	3.0	2.6	3.7	4.8	3.0	3.2	2.55	1.6	....	....	....
24	2.5	3.2	2.5	3.5	4.5	2.9	3.3	2.45	1.5	....	....	....
25	2.5	3.15	2.4	3.3	4.6	2.7	3.2	2.4	1.5	....	....	....
26	2.4	3.35	2.4	3.15	5.0	2.7	3.2	2.25	1.5	....	....	....
27	2.3	5.05	2.3	3.0	5.1	2.7	3.0	2.1	1.9	....	....	....
28	2.2	6.1	2.2	2.9	4.5	2.75	2.75	2.0	1.85	....	....	....
29	2.2	.....	2.2	2.8	4.2	3.1	2.6	2.0	2.2	....	....	....
30	2.1	.....	2.2	2.7	4.0	4.0	2.5	1.9	2.0	....	....	....
31	2.0	.....	2.2	.....	3.75	3.9	2.65	1.8	.....	.....	.....	.....

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Discharge measurements of White River, near Lead Hill, Arkansas.

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge.
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 19	W. N. Gladson	300	794	0.59	1.1	468
Nov. 22	W. N. Gladson	300	936	1.49	2.4	1398
Dec. 20	W. N. Gladson	292	905	1.48	2.4	1348
1910						
May 17	W. N. Gladson	320	2095	4.02	5.95	8700

Rating Table for White River at Bradleys Ferry, near Lead Hill, Arkansas, from October 1, 1909, to October 1, 1910.—Continued.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
1.00	300		2.60	1663		4.20	4525	
		35			118			215
1.10	335		2.70	1781		4.30	4740	
		46			127			217
1.20	381		2.80	1908		4.40	4957	
		54			137			219
1.30	435		2.90	2045		4.50	5176	
		62			155			220
1 40	497		3.00	2200		4.60	5396	
		68			156			221
1.50	565		3.10	2356		4.70	5617	
		73			163			223
1.60	638		3.20	2519		4.80	5840	
		80			176			228
1.70	718		3.30	2695		4.90	6068	
		86			186			232
1.80	804		3.40	2881		5.00	6300	
		94			194			243
1.90	898		3.50	3075		5.10	6543	
		102			198			245
2.00	1000		3.60	3273		5.20	6788	
		108			203			248
2.10	1108		3.70	3476		5.30	7036	
		109			206			249
2.20	1217		3.80	3682		5.40	7285	
		110			208			250
2.30	1327		3.90	3890		5.50	7535	
		111			210			251
2.40	1438		4.00	4100		5.60	7786	
		112			212			252
2.50	1550		4.10	4312		5.70	8038	
		113			213			253

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Rating Table for White River at Bradleys Ferry, near Lead Hill, Arkansas, from October 1, 1909, to October 1, 1910.—Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
5.80	8291		7.60	13149		9.30	18070	
		254			285			290
5.90	8545		7.70	13434		9.40	18360	
		255			287			290
6.00	8800		7.80	13721		9.50	18650	
		259			289			290
6.10	9059		7.90	14010		9.60	18940	
		260			290			290
6.20	9319		8.00	14300		9.70	19230	
		261			290			290
6.30	9580		8.10	14590		9.80	19520	
		263			290			290
6.40	9843		8.20	14880		9.90	19810	
		265			290			290
6.50	10108		8.30	15170		10.00	20100	
		268			290			290
6.60	10376		8.40	15460		10.10	20390	
		270			290			290
6.70	10646		8.50	15750		10.20	20680	
		272			290			290
6.80	10918		8.60	16040		10.30	20790	
		274			290			290
6.90	11192		8.70	16330		10.40	21260	
		276			290			290
7.00	11468		8.80	16620		10.50	21550	
		277			290			290
7.10	11745		8.90	16910		10.60	21840	
		278			290			290
7.20	12023		9.00	17200		10.70	22130	
		280			290			290
7.30	12303		9.10	17490		10.80	22420	
		281			290			290
7.40	12584		9.20	17780		10.90	22710	
		282			290			290
7.50	12866							
		283						

The above table is not applicable for ice or obstructed channel conditions. It is based on four discharge measurements made during August, November and December, 1909, and May, 1910, and is fairly well defined between gage hights 1 foot and 6 feet. Above gage hight 8 feet the rating curve is a tangent, the difference being 290 per tenth.

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Monthly discharge of White River at Bradleys Ferry, near Lead Hill, Arkansas, for 1919-1910. (*Drainage area,* 4,512 *square miles.*)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	.....	.....	.....	.....	.....
September	.....	.....	.....	.....	.....
October	565	335	399	.088	.10
November	1,908	435	1,120	.248	.28
December	8,291	638	2,412	.534	.62
The period	8,291	335	1,310	.290	.98
1910					
January	2,356	497	1,294	.286	.33
February	9,059	638	1,554	.344	.36
March	10,918	1,217	3,602	.798	.92
April	6,543	1,327	3,746	.830	.98
May	29,380	1,217	5,494	1.21	1.40
June	19,520	1,781	5,373	1.19	1.32
July	22,420	1,550	5,508	1.22	1.41
August	10,918	804	2,650	.587	.68
September	2,695	565	1,198	.265	.30
October	.....	.....	.....	.....	.....
Novembef	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The period	29,380	497	3,379	.748	7.61

Water power possibilities. On the reach of White River between Bradleys Ferry gaging station and the State line in Boone County, there is a total fall of about 52 feet in 21 miles. The immediate banks of the channel are from 20 to 30 feet high. As there are only very small tributaries emptying into the river in this distance, the flow in second-feet will be approximately constant at every point for any given date. Assuming the flow recorded at Bradleys Ferry, since the gage was established, to be the flow for all points between this station and the State line in Boone County, two or three dams suitably located to utilize this fall would be capable of developing power as shown in the following table:

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Table of available water power between State line and Bradleys Ferry.

Flow in second-feet, October, 1909, to October, 1910.		Horsepower.		
Minimum	Maximum	Minimum	Maximum	Average of Minimum and Maximum.
335	29,380	1583	138,887	7023

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WHITE RIVER AT COTTER, ARKANSAS.

A standard chain gage was installed on the up-stream guard rail of the St. Louis, Iron Mountain & Southern Railroad bridge across White River, near Cotter, on July 21, 1909. The chain of this gage is 43.45 feet long to the lower marker, and 63.45 feet to the upper marker, and is located in position by the following bench marks. Bench mark No. 1 is the top of a lag screw on the west side of a leaning sycamore tree on the edge of the river bank just above the bridge. Elevation, 15.36 feet above zero of gage. Bench mark No. 2 is the top of a lag screw on south side of the west tree of twin sycamore trees about 60 feet north of bench mark No. 1. Elevation, 20.58 feet above zero of gage.

Daily gage hight, in feet, of White River, at Cotter, Arkansas for part of 1909-1910. *Observer, S. Butterfield.—Continued.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	2.65	1.4	1.0	1.5	2.2
2	.....	.....	.....	.....	.....	.....	.....	2.6	1.4	1.0	1.45	2.2
3	.....	.....	.....	.....	.....	.....	.....	2.45	1.4	1.0	1.4	2.15
4	.....	.....	.....	.....	.....	.....	.....	2.4	1.3	1.0	1.3	2.1
5	.....	.....	.....	.....	.....	.....	.....	2.3	1.4	1.0	1.3	3.35
6	.....	.....	.....	.....	.....	.....	.....	2.3	1.4	1.0	1.95	6.1
7	.....	.....	.....	.....	.....	.....	.....	3.15	1.4	1.0	3.35	6.9
8	.....	.....	.....	.....	.....	.....	.....	2.45	1.4	1.0	2.45	6.8
9	.....	.....	.....	.....	.....	.....	.....	2.35	1.3	1.35	3.05	6.6
10	.....	.....	.....	.....	.....	.....	.....	2.2	1.3	1.65	2.95	5.55
11	.....	.....	.....	.....	.....	.....	.....	2.1	1.3	1.45	2.7	5.0
12	.....	.....	.....	.....	.....	.....	.....	2.3	1.3	1.2	2.9	4.7
13	.....	.....	.....	.....	.....	.....	.....	2.25	1.3	1.2	2.65	4.35
14	.....	.....	.....	.....	.....	.....	.....	2.1	2.45	1.2	2.55	4.2
15	.....	.....	.....	.....	.....	.....	.....	2.0	1.4	1.20	2.45	3.95
16	.....	.....	.....	.....	.....	.....	.....	2.0	1.3	1.25	2.4	3.75
17	.....	.....	.....	.....	.....	.....	.....	1.9	1.2	1.3	2.55	3.5
18	.....	.....	.....	.....	.....	.....	.....	1.8	1.2	1.3	3.0	3.35
19	.....	.....	.....	.....	.....	.....	.....	1.8	1.2	1.2	3.25	3.3
20	.....	.....	.....	.....	.....	.....	.....	1.75	1.2	1.2	3.35	3.15
21	.....	.....	.....	.....	.....	.....	3.9	1.65	1.3	1.3	3.2	3.0
22	.....	.....	.....	.....	.....	.....	3.7	1.6	1.3	1.3	3.1	3.0
23	.....	.....	.....	.....	.....	.....	3.5	1.6	1.25	1.3	3.05	2.9
24	.....	.....	.....	.....	.....	.....	3.4	1.5	1.2	1.3	3.0	2.8
25	.....	.....	.....	.....	.....	.....	3.2	1.4	1.2	1.2	2.75	2.65
26	.....	.....	.....	.....	.....	.....	3.1	1.4	1.2	1.2	2.55	2.5
27	.....	.....	.....	.....	.....	.....	3.1	1.4	1.2	1.25	2.45	2.5
28	.....	.....	.....	.....	.....	.....	3.0	1.3	1.1	1.3	2.3	2.5
29	.....	.....	.....	.....	.....	.....	2.85	1.3	1.1	1.3	2.3	2.35
30	.....	.....	.....	.....	.....	.....	2.75	1.3	1.0	1.3	2.2	2.3
31	.....	.....	.....	.....	.....	.....	2.7	1.3	.....	1.4	.....	2.2

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Daily gage hight, in feet, of White River, at Cotter, Arkansas, for part of 1909-1910. Observer, S. Butterfield.—Concluded.

	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	2.2	2.5	7.7	2.7	3.5	4.85	5.15	3.5	2.65	....	....	....
2	2.35	2.4	7.65	2.75	3.4	4.55	5.05	3.6	2.45	....	....	....
3	2.4	2.4	7.75	3.25	3.3	4.4	4.5	3.45	2.8	....	....	....
4	2.4	2.4	7.0	4.1	3.15	4.4	4.25	3.2	3.4	....	....	....
5	2.4	2.4	6.35	3.95	3.1	4.6	4.25	3.0	3.7	....	....	....
6	2.4	2.3	5.85	3.95	3.1	4.95	4.65	2.9	4.05	....	....	....
7	2.35	2.3	5.4	4.7	3.1	5.65	4.6	2.9	4.5	....	....	....
8	2.3	2.3	5.1	5.05	3.0	6.1	4.35	2.9	4.4	....	....	....
9	2.3	2.2	4.85	5.8	3.15	9.2	4.1	3.05	4.15	....	....	....
10	2.4	2.2	4.65	5.45	4.15	10.95	6.25	6.55	4.0	....	....	....
11	2.5	2.2	5.2	5.25	4.4	10.8	5.0	7.35	3.75	....	....	....
12	2.8	2.2	5.65	5.1	4.15	10.1	5.05	6.5	3.55	....	....	....
13	2.8	2.1	5.35	5.1	3.95	8.05	13.15	5.55	3.35	....	....	....
14	2.65	2.1	5.15	5.1	3.75	7.15	12.35	5.05	3.2	....	....	....
15	2.6	2.1	4.85	6.15	3.55	6.55	10.95	4.75	3.05	....	....	....
16	3.0	2.1	4.65	6.8	3.65	6.0	9.65	4.45	2.85	....	....	....
17	3.7	2.0	4.45	6.15	4.7	5.5	7.05	4.4	2.8	....	....	....
18	3.9	2.0	4.25	6.1	9.3	5.1	6.75	4.35	2.65	....	....	....
19	3.85	1.9	4.05	5.95	14.3	4.75	6.05	4.35	2.6	....	....	....
20	3.7	2.1	3.9	5.9	11.15	4.55	5.8	4.15	2.55	....	....	....
21	3.55	2.2	3.85	5.7	8.1	4.35	5.3	4.0	2.4	....	....	....
22	3.35	2.55	3.65	5.2	7.05	4.15	4.75	3.9	2.35	....	....	....
23	3.3	3.25	3.5	4.8	6.4	4.0	4.6	3.85	2.3	....	....	....
24	3.2	4.0	3.4	4.7	6.0	3.85	4.6	3.65	2.2	....	....	....
25	3.1	4.1	3.25	4.55	5.75	3.65	4.6	3.45	2.2	....	....	....
26	3.0	4.25	3.15	4.35	6.35	3.6	4.45	3.25	2.2	....	....	....
27	3.0	6.1	3.1	4.15	6.3	3.6	4.35	3.05	2.6	....	....	....
28	2.9	7.55	3.0	3.95	6.1	3.6	4.0	3.0	2.75	....	....	....
29	2.8	....	2.9	3.75	5.55	3.75	3.75	2.85	2.6	....	....	....
30	2.7	....	2.75	3.55	5.3	4.3	3.55	2.75	3.1	....	....	....
31	2.7	....	2.7	....	5.3	.....	3.5	2.7	....	....	....	....

Discharge measurements of White River, near Cotter, Arkansas.

Date.	Hydrographer.	Width.	Area of section	Mean velocity	Gage hight	Discharge.
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 31	W. N. Gladson	160	308	1.47	1.4	455*
Nov. 24	W. N. Gladson	420	1088	1.59	2.9	1737†
Dec. 22	W. N. Gladson	400	1029	1.61	2.85	1658†
1910						
May 18	W. N. Gladson	590	5559	4.81	11.65	28619‡

*300 ft. below bridge.
†500 ft. above bridge.
‡At railway bridge.

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Rating table for White River at Missouri Pacific Railway bridge, near Cotter, Arkansas, from July 21, 1909, to October 1, 1910.—Continued.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
1.00	300		3.50	2418		6.00	7200	
		48			131			250
1.10	348		3.60	2544		6.10	7450	
		52			134			255
1.20	400		3.70	2678		6.20	7705	
		56			137			262
1.30	456		3.80	2815		6.30	7967	
		59			140			270
1.40	515		3.90	2955		6.40	8237	
		62			145			280
1.50	577		4.00	3100		6.50	8517	
		64			148			290
1.60	641		4.10	3248		6.60	8807	
		64			151			310
1.70	705		4.20	3399		6.70	9177	
		65			155			318
1.80	770		4.30	3554		6.80	9435	
		65			164			330
1.90	835		4.40	3718		6.90	9765	
		65			175			335
2.00	900		4.50	3893		7.00	10100	
		68			185			338
2.10	968		4.60	4078		7.10	10438	
		71			195			340
2.20	1039		4.70	4273		7.20	10778	
		76			200			342
2.30	1115		4.80	4473		7.30	11120	
		80			212			346
2.40	1195		4.90	4685		7.40	11466	
		89			215			348
2.50	1284		5.00	4900		7.50	11814	
		92			218			350
2.60	1376		5.10	5118		7.60	12164	
		97			221			352
2.70	1473		5.20	5339		7.70	12516	
		104			223			358
2.80	1577		5.30	5562		7.80	12874	
		109			225			362
2.90	1691		5.40	5787		7.90	13236	
		114			228			364
3.00	1800		5.50	6015		8.00	13600	
		116			230			375
3.10	1916		5.60	6245		8.10	13975	
		119			232			386
3.20	2035		5.70	6477		8.20	14361	
		124			235			392
3.30	2159		5.80	6712		8.30	14753	
		126			241			410
3.40	2285		5.90	6953		8.40	15163	
		128			247			410

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Rating table for White River at Missouri Pacific Railway bridge, near Cotter, Arkansas, from July 21, 1909, to October 1, 1910.—Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
8.50	15573		9.40	19263		10.20	22543	
		410			410			410
8.60	15983		9.50	19673		10.30	22953	
		410			410			410
8.70	16393		9.60	20083		10.40	23363	
		410			410			410
8.80	16803		9.70	20493		10.50	23773	
		410			410			410
8.90	17213		9.80	20903		10.60	24183	
		410			410			410
9.00	17623		9.90	21313		10.70	24593	
		410			410			410
9.10	18033		10.00	21723		10.80	25003	
		410			410			410
9.20	18443		10.10	22133		10.90	25413	
		410			410			410
9.30	18853							
		410						

The above table is not applicable for ice or obstructed channel conditious. It is based on four discharge measurements made during August, November and December, 1909, and May, 1910, and is fairly well defined between gage hights 1 foot and 4 feet. Above gage hight 8 feet the rating curve is a tangent, the difference being 410 per tenth.

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Monthly discharge of White River near Cotter, Arkansas, for 1919-1910. (Drainage area, 4,800 square miles.)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	2,035	456	878	.182	.21
September	1,284	300	472	.098	.11
October	705	300	417	.086	.10
November	2,285	456	1,397	.291	.32
December	9,765	968	3,055	.637	.73
The period	9,765	300	1,243	.258	1.46
1910					
January	2,955	1,039	1,701	.354	.41
February	12,164	835	1,968	.410	.43
March	12,874	1,473	4,890	1.01	1.16
April	9,435	1,473	4,841	1.00	1.12
May	39,353	1,800	6,994	1.45	1.67
June	25,823	2,544	6,856	1.42	1.58
July	34,843	2,413	7,783	1.62	1.87
August	11,466	1,473	3,418	.712	.82
September	3,893	1,039	1,953	.406	.45
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The period	39,353	835	4,489	.935	9.52

In the portion of the river between Cotter and Bradleys Ferry, there is a fall of about 124 feet in a distance of 54 miles by river. The immediate banks of the stream are 20 to 30 feet high. If a number of power sites were distributed over the distance, and the entire fall made available for the average flow as shown by the records of the Cotter station, the following table indicates the available combined power:

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Table of available horsepower between Bradleys Ferry and Cotter Station.

Flow in second-feet recorded at Cotter station.		Horsepower.		
Minimum	Maximum	Minimum	Maximum	Average of Minimum and Maximum
300	39,353	3,381	443,615	223,498

WHITE RIVER AT BUFFALO CITY, ARKANSAS.

Between Cotter and Buffalo City, a distance of 12 miles by river, there is a fall of about 36 feet. Assuming the same flow here as has been found at Cotter, and that all the fall would be realized at suitable dam sites, the power available would be as follows:

Table of available horsepower between Cotter and Buffalo City.

Flow in second-feet at Cotter station.		Horsepower.		
Minimum	Maximum	Minimum	Maximum	Average of Maximum and Minimum
300	39,353	981	123,791	64,886

About 10.5 feet of the above fall occurs in 1.7 miles of river at Buffalo Shoal. A 10-foot dam at Buffalo City would develop about 37,850 horsepower on the assumption of the above average flow.

White River is not navigable above Buffalo Shoal, but is used for flotage of timber, fishing boats and other small crafts. The extreme variation of gage hight observed since the gage was established is 13.3 feet, but in extreme flood will reach approximately 34 feet.

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Elevations of water surface of North Fork of White River, Arkansas, above sea-level at Gulf.—Continued.

Temporary bench mark at Smiths Ferry near Henderson, cross on an elm tree with a nail driven in the center, about 1 foot above the ground. Tree stands on the right bank about 100 feet above the ferry and 20 feet from the edge of low water. Elevation 460.17 feet. River gage is on the left bank just below the feerry.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
Temporary bench mark		201.28	460.17	Assumed elevation of temporary bench mark.
34	1.28	200.00	458.89	Water Surface.
1,904	1.08	198.92	457.81	
4,012	1.94	196.98	455.87	
2,588	1.64	195.34	454.23	
2,640	1.62	193.72	452.61	
3,020	2.40	191.32	450.21	
2,360	2.50	188.82	447.71	
1,420	.90	187.92	446.81	
3,240	1.40	186.52	445.41	
1,904	4.52	182.00	440.89	Buzzards Roost Falls; 8.2 ft. fall in about 4,000 ft.
1,996	3.68	178.32	437.21	
2,300	1.20	177.12	436.01	
2,488	.64	176.48	435.37	
2,380	1.60	174.88	433.77	
1,820	.30	174.58	433.47	
972	3.50	171.08	429.97	
2,460	.80	170.28	429.17	Traceys Ford.
1,820	1.90			

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Elevations of water surface of North Fork of White River, Arkansas, above sea-level at Gulf.—Continued.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		168.38	427.27	
3,428	2.44			
		165.94	424.83	
2,740	1.20			
		164.74	423.63	
2,400	.40			
		164.34	423.23	
3,052	5.06			
		159.28	418.17	
2,100	.60			
		158.68	417.57	
2,480	.26			
		158.42	417.31	
2,180	.22			
		158.20	417.09	
2,196	3.12			
		155.08	413.97	
2,460	.74			
		154.34	413.23	9.26 ft. fall in about 7,000 ft.
2,500	5.40			
		148.94	407.83	
2,060	.16			
		148.78	407.67	Mouth of Big Creek.
1,452	.08			
		148.70	407.59	
1,560	1.80			
		146.90	405.79	Conley Ford.
1,780	2.50			
		144.40	403.29	
3,540	1.10			
		143.30	402.19	
2,500	1.80			
		141.50	400.39	
1,856	.78			
		140.72	399.61	
2,072	1.14			
		139.58	398.47	
2,396	2.32			
		137.26	396.15	
1,868	.94			
		136.32	395.21	Mouth of Otter Creek.
1,788	1.66			
		134.66	393.55	
3,160	3.16			

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Elevations of water surface of North Fork of White River, Arkansas, above sea-level at Gulf.—Concluded.

Distance Feet	Difference in elevation Feet	Elevation Feet	Corrected elevation Water surface	Remarks
		131.50	890.39	
2,420	4.80			7.96 ft. fall in 5,580 ft.
		126.70	385.59	
2,604	1.18			
		125.52	384.41	
2,868	4.48			
		121.04	379.93	Missouri Pacific Railway bridge at Norfork.

Distance from Smiths Ferry..... 18.71 miles.
Fall from Smiths Ferry.....78.96 feet.
Average fall per mile..... 4.21 feet.

NORTH FORK OF WHITE RIVER, SMITHS FERRY.

A staff gage in three sections, total length 25 feet, was installed by the Water Resources Branch of the United States Geological Survey at Smiths Ferry, near Henderson, Arkansas, on July 23, 1909. Each section of the gage is nailed to a tree, and the zero of the gage is referred to bench mark No. 1 and bench mark No. 2. Bench mark No. 1 is the top of a 20-penny wire nail driven in a sycamore tree to which the first section of the gage is attached. Elevation, 5.86 feet. Bench mark No. 2 is the top of a 20-penny wire nail driven into the east side of the tree, at the top of the bank almost directly east of the second section of the gage. Elevation, 26.49 feet.

This river has not been surveyed above Smiths Ferry. Below this point the fall is about 78 feet in approximately

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18 miles by river. This reach of the river contains numerous rapids. At Buzzards Roost Falls there is a fall of 8 feet in about 4,000 feet. If all the fall between Smiths Ferry and Norfork is made available by suitably located dams, the power, based on the flow recorded at Smiths Ferry would be as shown below:

Table of available horsepower between Smiths Ferry and Norfork.

Flow in second-feet.		Horsepower.		
Minimum	Maximum	Minimum	Maximum	Average of Minimum and Maximum
325	7,900	2,304	56,018	29,161

This river is not navigable and is not used extensively for flotage of timber. The maximum observed fluctuation of water surface during the time the gage has been installed is 4.55 feet, but from marks on the timber, it is thought that the maximum variation will reach 25 to 30 feet.

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Daily gage hight, in feet, of North Fork of White River, near Henderson, Arkansas, for part of 1909-1910. *Observers, F. S. Field and W. F. Smith.—Continued.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	2.1	1.7	1.5	1.6	1.8
2	.....	.....	.....	.....	.....	.....	.....	2.0	1.6	1.5	1.65	1.85
3	.....	.....	.....	.....	.....	.....	.....	2.9	1.55	1.5	1.8	1.9
4	.....	.....	.....	.....	.....	.....	.....	2.9	1.5	1.4	1.75	1.8
5	.....	.....	.....	.....	.....	.....	.....	2.8	1.65	1.45	1.65	1.8
6	.....	.....	.....	.....	.....	.....	.....	2.8	1.6	1.5	1.6	1.85
7	.....	.....	.....	.....	.....	.....	.....	2.7	1.5	1.6	1.7	1.9
8	.....	.....	.....	.....	.....	.....	.....	2.65	1.6	1.6	1.8	2.0
9	.....	.....	.....	.....	.....	.....	.....	2.55	1.6	1.6	1.9	2.5
10	.....	.....	.....	.....	.....	.....	.....	2.5	1.55	1.6	1.85	2.65
11	.....	.....	.....	.....	.....	.....	.....	2.4	1.5	1.5	1.75	1.9
12	.....	.....	.....	.....	.....	.....	.....	2.35	1.5	1.5	1.65	1.9
13	.....	.....	.....	.....	.....	.....	.....	1.95	1.5	1.5	1.6	1.8
14	.....	.....	.....	.....	.....	.....	.....	1.7	1.7	1.45	1.5	1.95
15	.....	.....	.....	.....	.....	.....	.....	1.7	1.85	1.4	1.55	2.0
16	.....	.....	.....	.....	.....	.....	.....	1.7	1.75	1.4	1.7	1.9
17	.....	.....	.....	.....	.....	.....	.....	1.6	1.65	1.5	1.75	1.8
18	.....	.....	.....	.....	.....	.....	.....	1.6	1.5	1.5	1.7	1.7
19	.....	.....	.....	.....	.....	.....	.....	1.6	1.5	1.45	1.65	1.7
20	.....	.....	.....	.....	.....	.....	.....	1.5	1.5	1.4	1.7	1.7
21	.....	.....	.....	.....	.....	.....	.....	1.4	1.65	1.5	1.6	1.8
22	.....	.....	.....	.....	.....	.....	.....	1.4	1.75	1.5	1.65	1.8
23	.....	.....	.....	.....	.....	.....	2.2	1.4	1.6	1.5	1.7	1.8
24	.....	.....	.....	.....	.....	.....	2.15	1.35	1.5	1.5	1.65	1.7
25	.....	.....	.....	.....	.....	.....	2.1	1.3	1.5	1.5	1.6	1.6
26	.....	.....	.....	.....	.....	.....	2.1	1.3	1.5	1.5	1.6	1.6
27	.....	.....	.....	.....	.....	.....	2.05	1.3	1.5	1.45	1.6	1.55
28	.....	.....	.....	.....	.....	.....	2.0	1.3	1.5	1.4	1.7	1.5
29	.....	.....	.....	.....	.....	.....	2.0	2.0	1.6	1.4	1.7	1.6
30	.....	.....	.....	.....	.....	.....	2.55	2.0	1.55	1.4	1.8	1.6
31	.....	.....	.....	.....	.....	.....	2.1	1.9	.....	1.5	.....	1.6

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Daily gage hight, in feet, of North Fork of White River, near Henderson, Arkansas, for part of 1909-1910.
Observers, F. S. Field and W. F. Smith.
—Concluded.

	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	1.6	1.7	3.45	1.7	1.9	.....	2.0	2.5	1.2	....	....	....
2	1.6	1.7	2.9	1.65	1.8	.....	1.95	2.25	1.2	....	....	....
3	1.7	1.7	2.75	1.6	1.8	.....	2.0	2.0	2.2	....	....	....
4	1.7	1.7	2.7	1.65	1.7	.....	2.3	1.9	2.9	....	....	....
5	1.7	1.7	2.65	1.8	1.6	2.5	2.35	1.9	2.8	....	....	....
6	1.8	1.55	2.55	1.95	1.85	2.1	2.9	1.9	3.2	....	....	....
7	1.8	1.5	2.6	2.5	1.9	2.2	2.7	1.9	2.9	....	....	....
8	1.8	1.5	2.7	2.55	1.85	5.55	2.45	1.9	2.4	....	....	....
9	1.8	1.5	2.8	2.35	1.8	5.0	2.35	1.95	2.2	....	....	....
10	1.7	1.6	3.2	2.3	1.85	4.15	4.6	2.4	2.0	....	....	....
11	1.7	1.6	3.45	2.2	1.9	3.45	3.4	2.25	1.9	....	....	....
12	1.7	1.55	2.95	2.3	2.0	3.0	4.7	2.15	1.8	....	....	....
13	1.7	1.5	2.8	2.6	1.9	3.0	5.4	2.0	1.7	....	....	....
14	1.65	1.5	2.75	3.1	1.8	2.45	4.0	2.0	1.6	....	....	....
15	1.65	1.55	2.6	3.45	1.95	2.35	3.95	1.95	1.4	....	....	....
16	1.7	1.6	2.5	3.65	2.4	2.1	3.25	1.9	1.2	....	....	....
17	1.75	1.6	2.4	3.55	2.35	2.1	4.3	1.9	1.0	....	....	....
18	1.8	1.6	2.3	3.15	2.15	2.15	3.55	2.7	1.7	....	....	....
19	1.7	1.6	2.2	2.9	1.95	2.15	2.9	2.4	1.7	....	....	....
20	1.7	1.6	2.15	2.45	1.9	2.1	2.7	2.25	1.7	....	....	....
21	1.6	1.5	2.1	2.35	1.9	2.05	2.4	2.0	1.7	....	....	....
22	1.65	1.5	2.0	2.3	1.9	2.05	2.2	1.9	1.6	....	....	....
23	1.7	1.6	2.0	2.2	....	2.05	3.8	1.85	1.6	....	....	....
24	1.7	1.65	1.95	2.2	....	2.0	2.3	1.8	1.6	....	....	....
25	1.7	1.7	1.9	2.1	....	2.0	2.2	1.8	1.7	....	....	....
26	1.6	1.7	1.9	2.1	....	2.0	2.0	1.8	1.7	....	....	....
27	1.6	4.35	1.8	2.1	....	2.0	2.0	1.9	1.8	....	....	....
28	1.6	4.00	1.7	2.0	....	2.0	2.0	1.8	2.0	....	....	....
29	1.6	.....	1.7	1.95	....	2.0	2.0	1.8	2.0	....	....	....
30	1.7	.....	1.8	1.9	....	2.0	2.4	1.8	1.8	....	....	....
31	1.7	.....	1.8	....	....	.....	2.7	1.6	....	....	....	....

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Discharge measurements of North Fork of White River, near Henderson, Arkansas.

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Sept. 4	W. N. Gladson	210	709	1.20	1.4	851
Nov. 26	W. N. Gladson	230	718	1.00	1.6	719
Dec. 21	W. N. Gladson	240	777	1.17	1.75	911
1910						
May 19	W. N. Gladson	295	848	1.28	1.95	1,106

Rating table for North Fork of White River at Smiths Ferry, near Henderson, Arkansas, from July 23, 1909, to October 1, 1910.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
1.00	325		2.00	1150		3.00	2600	
		40			120			174
1.10	365		2.10	1270		3.10	2774	
		51			128			179
1.20	416		2.20	1398		3.20	2953	
		60			132			182
1.30	476		2.30	1530		3.30	3135	
		74			134			193
1.40	550		2.40	1664		3.40	3328	
		82			140			199
1.50	632		2.50	1804		3.50	3527	
		90			135			207
1.60	722		2.60	1949		3.60	3734	
		98			152			210
1.70	820		2.70	2101		3.70	3944	
		102			162			214
1.80	922		2.80	2263		3.80	4158	
		110			167			218
1.90	1032		2.90	2430		3.90	4376	
		118			170			224
						4.00	4600	

The above table is not applicable for ice or obstructed channel conditions. It is based on three discharge measurements made during November and December, 1909, and May, 1910, and is not well defined.

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Monthly discharge of North Fork of White River, near Henderson, Arkansas, for 1909-1910. (*Drainage area,* 898 *square miles.*)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	...	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	2,430	476	1,191	1.32	1.52
September	1,032	632	723	.805	.90
October	722	550	625	.695	.80
November	1,032	632	822	.915	1.06
December	2,101	632	970	1.08	1.25
The period	2,430	476	866	.964	5.45
1910					
January	922	722	817	.909	1.05
February	5,536	632	1,037	1.15	1.20
March	3,527	820	1,781	1.98	2.28
April	3,944	722	1,712	1.90	2.12
May	1,665	722	1,041	1.15	1.33
June	7,900	1,150	2,009	2.23	2.49
July	7,200	1,150	2,625	2.92	3.37
August	1,664	722	1,183	1.31	1.51
September	2,430	325	927	1.03	1.15
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The period	7,900	325	1,459	1.62	16.49

LITTLE RED RIVER AT PANGBURN GAGING STATION.

This station was established July 15, 1909, and the gage is read once a day. It is a staff gage in three sections fastened to the down-stream side of trees on the right bank of the river at Skillerns Ferry. Bench mark No. 1 is a drift nail set in the root on the south side of an elm tree, 75 feet east of the first section of the gage. The tree is on the

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east side of the approach to the ferry-boat landing. Elevation, 6.26 feet. Bench mark No. 2 is the top of an 8-inch drift nail set in the root on the west side of a sweet gum tree, at the west side of approach to the ferry-boat landing. The tree is at the top of the river bank. Elevation, 31.13 feet.

The banks of this river are high and wooded. The extreme variation of gage hight that has been observed since the gage was established is 24 feet. This river has not been surveyed.

Daily gage hight, in feet, of Little Red River, near Pangburn, Arkansas, for part of 1909-1910.
Observer, A. J. Stolz.—Continued.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	....	.....	.....	2.0	1.5	1.4	1.6	3.0
2	.....	.....	.....	.....	....	.....	.....	1.9	1.4	1.5	1.6	2.9
3	.....	.....	.....	.....	....	.....	.....	1.9	1.4	1.5	1.6	2.9
4	.....	.....	.....	.....	....	.....	.....	1.8	1.5	1.5	1.6	5.4
5	.....	.....	.....	.....	....	.....	.....	1.8	1.5	1.5	1.5	4.8
6	.....	.....	.....	.....	....	.....	.....	1.8	1.5	1.6	1.5	4.5
7	.....	.....	.....	.....	....	.....	.....	1.8	1.8	1.6	2.2	5.1
8	.....	.....	.....	.....	....	.....	.....	1.7	1.6	1.5	2.5	5.0
9	.....	.....	.....	.....	....	.....	.....	1.7	1.5	1.5	2.4	4.8
10	.....	.....	.....	.....	....	.....	.....	1.7	1.5	1.5	2.3	4.4
11	.....	.....	.....	.....	....	.....	.....	1.7	1.5	1.4	2.4	4.5
12	.....	.....	.....	.....	....	.....	.....	1.7	1.4	1.4	3.0	7.5
13	.....	.....	.....	.....	....	.....	.....	1.7	1.4	1.4	2.9	13.4
14	.....	.....	.....	.....	....	.....	2.65	1.6	1.4	1.5	2.9	10.6
15	.....	.....	.....	.....	....	.....	2.9	1.6	1.4	1.5	2.9	8.2
16	.....	.....	.....	.....	....	.....	3.2	1.6	1.4	1.5	3.0	7.0
17	.....	.....	.....	.....	....	.....	3.0	1.7	1.4	1.5	2.9	6.4
18	.....	.....	.....	.....	....	.....	3.2	1.8	1.3	1.5	8.4	5.8
19	.....	.....	.....	.....	....	.....	3.1	1.7	1.3	1.5	6.4	5.2
20	.....	.....	.....	.....	....	.....	3.1	1.7	1.3	1.5	5.0	4.9
21	.....	.....	.....	.....	....	.....	3.1	1.7	1.6	1.6	4.3	4.7
22	.....	.....	.....	.....	....	.....	2.1	1.7	1.8	1.5	3.9	4.3
23	.....	.....	.....	.....	....	.....	2.8	1.6	2.2	1.6	3.7	3.9
24	.....	.....	.....	.....	....	.....	2.2	1.6	1.8	1.6	3.5	3.8
25	.....	.....	.....	.....	....	.....	2.2	1.6	1.6	1.6	3.6	3.7
26	.....	.....	.....	.....	....	.....	2.1	1.6	1.6	1.6	3.6	3.7
27	.....	.....	.....	.....	....	.....	2.1	1.6	1.5	1.6	3.5	3.6
28	.....	.....	.....	.....	....	.....	2.7	1.6	1.5	1.6	3.4	3.5
29	.....	.....	.....	.....	....	.....	2.2	1.6	1.4	1.5	3.2	3.4
30	.....	.....	.....	.....	....	.....	2.0	1.5	1.4	1.5	3.0	3.3
31	.....	.....	.....	.....	....	.....	2.0	1.5	....	1.5	....	3.2

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Daily gage hight, in feet, of Little Red River, near Pangburn, Arkansas, for part of 1909-1910. Observer, A. J. Stolz.—Concluded.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	3.1	3.7	16.4	3.5	3.7	6.2	3.9	3.1	2.8	....	....	....
2	3.1	3.6	11.4	3.3	3.5	5.3	4.1	3.0	2.8	....	....	....
3	3.0	3.4	9.2	3.5	3.4	4.5	9.6	2.9	2.8	....	....	....
4	3.0	3.3	7.9	4.1	3.3	4.8	10.5	2.7	2.9	....	....	....
5	3.1	3.2	7.1	6.7	3.2	4.7	12.4	2.6	2.9	....	....	....
6	3.4	3.0	6.5	24.3	3.1	4.5	9.3	2.6	2.8	....	....	....
7	6.4	3.0	6.1	16.0	3.1	4.3	7.5	2.5	2.7	....	....	....
8	6.3	3.1	5.6	12.6	2.9	4.6	6.4	2.6	2.6	....	....	....
9	5.7	3.0	5.3	9.4	2.9	5.4	5.5	2.8	3.7	....	....	....
10	5.4	3.0	5.1	7.5	2.8	12.0	4.7	4.1	3.3	....	....	....
11	5.1	2.9	6.6	7.1	2.8	18.5	4.4	6.6	2.8	....	....	....
12	4.9	2.9	8.6	6.7	2.7	16.4	9.1	5.3	2.8	....	....	....
13	4.8	2.8	7.3	6.5	2.7	11.9	7.4	4.4	2.7	....	....	....
14	5.1	2.8	6.5	6.3	2.6	8.7	7.3	4.5	2.6	....	....	....
15	5.5	2.7	6.0	6.0	2.6	6.8	7.1	4.8	2.5	....	....	....
16	5.4	2.7	5.6	14.0	2.9	5.9	6.7	5.6	2.4	....	....	....
17	5.2	2.8	5.2	14.2	4.6	5.4	6.0	6.0	2.4	....	....	....
18	5.1	2.8	4.8	11.8	20.1	4.8	5.5	5.2	2.3	....	....	....
19	5.4	2.9	4.5	9.4	13.6	4.3	5.0	4.8	2.3	....	....	....
20	7.5	2.8	4.3	8.0	9.8	4.0	4.4	4.6	2.2	....	....	....
21	7.1	2.8	4.3	7.0	8.4	3.8	4.0	6.0	2.2	....	....	....
22	6.3	2.8	4.2	6.4	7.8	3.6	3.6	5.2	2.1	....	....	....
23	5.8	3.0	4.4	5.9	14.7	3.5	3.4	4.7	2.1	....	....	....
24	5.4	3.9	4.7	5.4	18.8	3.5	3.3	4.4	2.1	....	....	....
25	5.1	4.8	4.5	4.9	25.4	3.8	8.1	3.8	2.1	....	....	....
26	4.8	5.2	4.3	4.5	14.1	3.6	6.4	3.4	2.0	....	....	....
27	4.6	10.8	4.1	4.4	9.7	3.5	5.0	3.4	2.0	....	....	....
28	4.5	24.4	4.0	4.2	7.9	3.8	4.5	3.6	2.2	....	....	....
29	4.2	.....	3.8	4.0	6.6	4.9	4.0	3.3	2.3	....	....	....
30	4.0	.....	3.7	3.9	6.0	4.5	3.6	3.1	2.4	....	....	....
31	3.8	....	3.9	.....	5.6	....	3.3	3.0	....	....	....	....

Discharge measurements of Little Red River, near Pangburn, Arkansas.

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Nov. 28	W. N. Gladson	170	552	0.59	3.1	329
Dec. 25	W. N. Gladson	200	674	0.94	3.7	637
1910						
May 21	W. N. Gladson	222	1964	1.60	8.10	3400

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Rating table for Little Red River at Skillerns Ferry, near Pangburn, Arkansas, from July 14, 1909, to October 1, 1910.—Continued.

Gage Hight	Discharge	Difference	Gage Hight	Discharge	Difference	Gage Hight	Discharge	Difference
2.00	100		4.40	989		6.80	2418	
		1			55			66
2.10	101		4.50	994		6.90	2484	
		2			55			66
2.20	103		4.60	1049		7.00	2550	
		3			56			66
2.30	106		4.70	1105		7.10	2616	
		6			56			66
2.40	112		4.80	1161		7.20	2682	
		11			57			66
2.50	123		4.90	1218		7.30	2748	
		16			57			67
2.60	139		5.00	1275		7.40	2815	
		18			59			67
2.70	157		5.10	1834		7.50	2882	
		25			61			67
2.80	182		5.20	1395		7.60	2949	
		30			62			69
2.90	212		5.30	1457		7.70	3018	
		38			62			69
3.00	250		5.40	1519		7.80	3087	
		43			63			69
3.10	293		5.50	1582		7.90	3156	
		44			63			69
3.20	337		5.60	1645		8.00	3225	
		45			63			70
3.30	382		5.70	1708		8.10	3925	
		46			64			70
3.40	428		5.80	1772		8.20	3365	
		47			64			70
3.50	475		5.90	1836		8.30	3435	
		48			64			70
3.60	523		6.00	1900		8.40	3505	
		49			64			70
3.70	572		6.10	1964		8.50	3575	
		50			64			70
3.80	622		6.20	2028		8.60	3645	
		51			64			70
3.90	673		6.30	2092		8.70	3715	
		52			64			70
4.00	725		6.40	2156		8.80	3785	
		53			65			70
4.10	778		6.50	2221		8.90	3855	
		53			65			70
4.20	831		6.60	2286		9.00	3925	
		54			66			70
4.30	885		6.70	2352		9.10	3995	
		54			66			70

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Rating table for Little Red River at Skillerns Ferry, near Pangburn, Arkansas, from July 14, 1909, to October 1, 1910.—Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
9.20	4065		10.20	4765		11.10	5395	
		70			70			70
9.30	4135		10.30	4835		11.20	5465	
		70			70			70
9.40	4205		10.40	4905		11.30	5535	
		70			70			70
9.50	4275		10.50	4975		11.40	5605	
		70			70			70
9.60	4345		10.60	5045		11.50	5675	
		70			70			70
9.70	4415		10.70	5115		11.60	5745	
		70			70			70
9.80	4485		10.80	5185		11.70	5815	
		70			70			70
9.90	4555		10.90	5255		11.80	5885	
		70			70			70
10.00	4625		11.00	5325		11.90	5955	
		70			70			70
10.10	4695							
		70						

The above table is not applicable for ice or obstructed channel conditions. It is based on three discharge measurements made during November and Decenber, 1909, and May, 1910, and is not well defined. Above gage hight 8 feet the rating curve is a tangent, the difference being 70 per tenth.

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.

Temporary bench mark, 8-penny wire nail driven into a sweet gum tree, 4 feet above the ground. Tree stands on the right bank, 4 feet from water, at a point due east from Boxley, Arkansas, in the northeast corner of Sec. 10, T. 15 N., R. 23 W. Elevation, 1,077.86 feet.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		1,073.03	Water surface opposite temporary bench mark.
500	.81	1,072.22	
788	5.06	1,067.16	Fall of 6.5 ft. in 1,434 ft.
646	1.45	1,065.71	
1,120	.02	1,065.69	
900	4.28	1,061.41	
1,042	5.88	1,055.53	
594	4.01	1,051.52	
1,552	3.74	1,047.78	
844	2.98	1,044.80	
608	2.46	1,042.34	
808	2.12	1,040.22	
1,004	2.62	1,037.60	Fall of 40.2 ft. in 2.05 miles.
1,138	.72	1,036.88	
798	1.97	1,034.91	
700	1.68	1,033.23	
338	1.40	1,031.83	
490	2.99	1,028.84	Jeffords Ford.
1,288	.43		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		1,028.41	
720	3.73	1,024.68	
1,044	4.12	1,020.56	
1,684	2.54	1,018.02	
882	2.70	1,015.32	
692	1.84	1,013.48	
538	2.95	1,010.53	
1,351	2.89	1,007.64	Addis Creek.
2,454	2.85	1,004.79	
298	1.21	1,003.58	Fall of 34 ft. in 4 miles.
998	.80	1,002.78	
462	1.24	1,001.54	
468	1.57	999.97	
1,118	4.50	995.47	
1,412	.16	995.31	
684	3.48	991.83	
1,332	2.09	989.74	
438	1.69	988.05	
642	2.08	985.97	
758	1.23	984.74	
828	3.26	981.48	
816	2.84	978.64	
1,572	.31	978.33	
826	.35		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		977.98	
812	2.32		
		975.66	
354	1.63		
		974.03	
938	2.19		
		971.84	Steels Creek.
1,086	2.86		
		968.98	
1,042	4.48		
		964.50	
1,644	.92		
		963.58	
1,452	2.47		
		961.11	
1,410	4.25		
		956.86	Erringtons Ford.
510	1.61		
		955.25	
558	3.10		
		952.15	
1,240	.12		
		952.03	
934	2.31		
		949.72	U. S. G. S. B. M., elevation 959 ft.; datum, Fayetteville, Ark.
1,296	1.42		
		948.30	
940	.16		
		948.14	
906	4.18		
		943.96	
1,150	3.72		
		940.24	
1,016	1.02		
		939.22	
922	2.59		
		936.63	
960	.65		
		935.98	
808	1.29		
		934 69	
1,070	.87		
		934.82	
1,292	3.32		
		931.00	
1,176	.77		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		930.23	
736	1.97		
		928.26	
848	.01		
		928.25	Sneeds Creek.
834	2.99		
		925.26	
580	3.42		
		921.84	
880	1.53		
		920.31	
840	3.50		
		916.81	
1,284	3.01		
		913.80	
984	2.16		
		911.64	
642	26		
		911.38	
1,044	.02		
		911.36	
1,936	3.12		
		908.24	
1,036	2.82		
		905.42	Arbrough Ford.
1,134	1.99		
		903.43	
1,468	1.58		
		901.85	
802	2.01		
		899.84	
1,186	.60		
		899.24	
794	4.82		
		894.42	
998	1.91		
		892.51	
728	.99		
		891.52	
610	2.04		
		889.48	
984	2.92		
		886.56	
1,064	1.16		
		885.40	
1,030	3.83		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation. Water surface Feet	Remarks
		881.57	
716	.71	880.86	
680	1.34	879.52	
800	.06	879.46	
824	3.35	876.11	
1,124	.14	875.97	
936	2.32	873.65	
728	.10	873.55	
736	3.32	870.23	
1,130	1.21	869.02	
1,316	.20	868.82	
1,310	1.02	867.80	
664	2.93	864.87	
610	.60	864.27	
988	2.77	861.50	
954	4.19	857.31	
1,252	2.22	855.09	
982	.35	854.74	
776	1.20	853.54	
670	1.17	852.37	
922	.95	851.42	
518	.37	851.05	
1,060	2.15	848.90	
796	.61		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		848.29	Farmer Ford.
1,032	1,96		
		946.33	
1,254	.55		
		845.78	
912	2.36		
		843.42	
1,798	.05		
		843.37	Mouth of Cecils Creek, Young Ford. U. S. G. S. B. M., elevation 896 ft.; datum, Fayetteville, Ark.
1,028	2.68		
		840.69	
1,488	5.19		
		835.50	
1,056	2.24		
		833.26	
928	2.24		
		831.02	
2,548	2.64		
		828.38	
1,096	3.67		
		824.71	
1,134	1.93		
		822.78	
976	.35		
		822.43	
1,132	3.56		
		818.87	
508	.49		
		818.38	
1,128	.85		
		817.53	
1,528	1.86		
		815.67	
642	2.31		
		813.36	
1,840	.90		
		812.46	
880	.42		
		812.04	
810	.43		
		811.61	
1,024	2.12		
		809.49	
532	2.18		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		807.31	
1,072	.76		
		806.55	
1,782	1.31		
		805.24	
1,234	2.40		
		802.84	
1,122	.67		
		802.17	
1,592	1.67		
		800.50	
1,518	2.07		
		798.43	
1,536	2.99		
		795.44	
1,286	1.99		
		793.45	
614	.22		
		793.23	
1,820	2.00		
		791.23	
1,544	2.92		
		788.31	
996	2.26		
		786.05	
1,372	.02		
		786.03	
884	1.62		
		784.41	
1,220	1.30		
		783.11	
1,240	3.80		
		779.31	
1,228	1.40		
		777.91	
2,020	.40		
		777.51	
1,100	1.80		
		775.71	
684	1.20		
		774.51	
1,272	.58		
		773.93	Mill Creek.
1,300	.24		
		773.69	
824	1.32		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		772.37	Harrison Jasper Road.
772	4.20	768.17	
1,036	.12	768.05	
1,968	.14	767.91	
1,100	2.90	765.01	U. S. G. S. B. M., elevation 796 ft.; datum, Fayetteville, Ark.
1,724	1.92	763.09	
1,412	1.54	761.55	Shaddox Ford.
1,454	2.90	758.65	
784	.01	758.64	
1,810	1.40	757.24	
1,856	4.06	753.18	
1,636	.80	752.38	Mouth of Little Buffalo.
2,400	3.30	749.08	
1,826	1.12	747.96	
1,172	2.78	745.18	Mouth of Wells Creek.
1,164	.03	745.15	
1,516	1.26	743.89	
1,172	.96	742.93	
1,184	2.46	740.47	
662	.15	740.32	
1,078	.77	739.55	
744	.18	739.37	
1,092	1.14	738.23	
1,242	1.40		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		736.83	
1,376	.26		
		736.57	
1,036	1.08		
		735.49	
1,460	.04		
		735.45	
1,292	1.30		
		734.15	
1,646	1.03		
		733.12	
540	1.16		
		731.96	
1,022	.35		
		731.61	
1,200	2.42		
		729.19	
1,432	1.26		
		727.93	
852	1.37		
		726.56	
1,880	.56		
		726.00	
1,772	1.68		
		724.32	
2,284	2.30		
		722.02	
1,644	2.14		
		719.88	
1,174	.01		
		719.87	
1,632	1.09		
		718.78	
1,544	1.34		
		717.44	Ferry.
2,132	.26		
		717.18	Mouth of Big Creek.
2,168	3.15		
		714.03	
1,928	3.10		
		710.93	
1,106	.33		
		710.60	
1,686	1.45		
		709.15	
1,568	1.82		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		707.38	
3,606	.80		
		706.53	
1,700	1.02		
		705.51	
1,346	1.59		
		703.92	
1,508	.10		
		703.82	
1,990	4.60		
		699.22	Ford.
2,432	.01		
		699.21	
882	2.00		
		697.21	
1,314	1.79		
		695.42	
2,028	1.01		
		694.41	
1,716	2.78		
		691.63	
1,550	1.55		
		690.08	Stave Factory Boom.
1,950	1.46		
		688.62	
2,284	.90		
		687.72	
2,746	.33		
		687.39	Mt. Hersey.
2,116	3.42		
		683.97	
2,372	2.57		
		681.40	
2,948	2.48		
		678.92	
3,000	1.40		
		677.52	
2,136	.25		
		677.27	Mouth of Cave Creek, Hale Ford.
2,020	3.26		
		674.01	
1,888	1.44		
		672.57	
2,038	3.60		
		668.97	
1,570	1.12		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		667.85	Mouth of Cane Creek.
2,484	.12	667.73	
2,226	.74	666.99	
1,750	2.89	664.10	
1,724	1.60	662.50	
2,350	2.40	660.10	
3,312	.78	659.32	
1,904	.50	658.82	
1,810	1.99	656.83	
3,096	.38	656.45	
2,380	2.75	653.70	Woolem Ford.
2,460	1.60	652.10	Mouth of Richland Creek.
1,604	3.32	648.78	
2,074	2.18	646.60	
3,310	.55	646.05	
1,886	4.22	641.83	
1,544	1.00	640.83	
2,046	1.30	639.53	
3,460	5.10	634.43	
2,118	.08	634.35	
2,236	4.26	630.09	Bend Ford, mouth of Bend Branch.
2,374	.31	629.78	
2,808	5.31	624.47	Margaret White Ford.
2,908	1.89		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		622.58	
2,266	.93	621.65	
2,396	4.43	617.22	
2,980	2.12	615.10	
3,418	2.14	612.96	
1,262	3.13	609.83	
1,144	1.32	608.51	
2,160	.02	608.49	
2,470	1.17	607.32	
1,878	1.73	605.59	
1,480	.89	604.70	
2,426	4.02	600.68	
3,070	1.15	599.53	
968	.50	599.03	
2,376	.18	598.85	
2,216	4.08	594.77	
2,184	.90	598.87	
1,732	1.46	592.41	
2,494	1.40	591.01	
1,852	2.54	588.47	
758	.40	588.07	
1,620	2.87	585.20	
3,610	1.20	584.00	
1,734	2.90		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		581.10	Mouth of Craney Creek.
2,116	1.15		
		579.95	Near mouth of Mill Creek.
2,650	.80		
		579.15	
2,282	3.97		
		575.18	
3,092	1.20		
		573.98	Grinders Ferry.
2,552	.78		
		573.20	
1,904	2.16		
		571.04	
1,924	1.46		
		569.58	
1,578	1.55		
		568.03	
1,768	.12		
		567.91	
2,826	2.85		
		565.06	
2,930	2.60		
		562.46	
2,502	.10		
		562.36	
2,530	.25		
		562.11	
1,512	2.25		
		559.86	Gilbert, Arkansas.
1,820	.92		
		558.94	
1,616	1.80		
		557.14	
2,870	1.05		
		556.09	
928	1.98		
		554.11	Mouth of Bear Creek.
752	.97		
		553.14	
1,368	2.46		
		550.68	
1,872	.74		
		549.94	
188	.06		
		549.88	Under Missouri & North Arkansas Railway crossing. U. S. G. S. Gaging station.
2,860	.90		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		548.98	
1,722	.79		
		548.19	
1,332	1.64		
		546.55	
668	.59		
		545.96	
2,520	2.25		
		543.71	
1,456	.10		
		543.61	
2,098	.24		
		543.37	
3,160	1.35		
		542.02	
2,124	.70		
		541.32	
2,428	.91		
		540.41	
2,890	2.16		
		538.25	
2,620	1.80		
		536.45	
2,538	2.33		
		534.12	
3,780	1.45		
		532.67	
3,140	1.57		
		531.10	
1,938	3.04		
		528.06	Mouth of Little Rock Creek.
2,914	.50		
		527.56	
2,854	1.83		
		525.73	
1,672	2.63		
		523.10	
2,338	1.07		
		522.03	
2,624	1.57		
		520.46	
2,348	.84		
		519.62	
2,150	1.18		
		518.44	
1,556	1.42		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		517.02	
2,656	2.18		
		514.84	
3,216	1.61		
		513.23	
3,114	2.02		
		511.21	
2,778	.49		
		510.72	
1,300	.57		
		510.15	
2,062	1.15		
		509.00	
1,744	1.62		
		507.38	Mouth of Spring Creek.
1,032	1.68		
		505.70	
1,522	2.46		
		503.24	
3,030	.62		
		502.62	
1,956	.28		
		502.34	
2,154	2.31		
		500.03	
2,226	1.24		
		498.79	
1,804	1.54		
		497.25	
2,867	1.17		
		496.08	
2,572	.28		
		495.80	Mouth of Water Creek.
1,602	2.14		
		493.66	Mouth of Kimball Creek.
1,924	2.48		
		491.18	
1,560	.72		
		490.46	
2,146	.17		
		490.29	
2,570	.85		
		489.44	
1,682	2.64		
		486.80	
2,564	1.44		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		485.36	
1,598	2.06		
		483.30	
2,164	.20		
		483.10	
2,666	.25		
		482.85	
3,030	3.35		
		479.50	
1,888	.09		
		479.41	
1,712	1.02		
		478.39	
2,782	1.50		
		476.89	
2,384	2.48		
		474.41	
3,216	.23		
		474.18	
2,222	2.92		
		471.26	
1,452	.76		
		470.50	
3,720	2.20		
		468.30	
1,666	1.68		
		466.62	West side of Horseshoe Bend.
1,450	.55		
		466.07	
3,644	1.18		
		464.89	
2,134	1.00		
		463.89	
1,888	.05		
		463.84	
2,710	.17		
		463.67	Red Cloud Mine.
2,756	1.15		
		462.52	Mouth of Blue John Creek.
1,168	3.08		
		459.44	
3,156	2.33		
		457.11	
3,198	.18		
		456.93	Mouth of Cabin Creek.
3,466	.60		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		456.33	
1,388	.06		
		456.27	Mouth of Cedar Creek.
1,568	4.26		
		452.01	
2,786	3.35		
		448.66	
3,784	2.77		
		445.89	
2,316	.09		
		445.80	East side of Horseshoe Bend. Fall of 20.82 ft. in 2,500 ft. across neck, or 7.08 miles around.
3,970	2.80		
		443.00	
3,030	2.22		
		440.78	
2,816	.50		
		440.28	
2,454	.83		
		439.45	
1,308	2.25		
		437.20	
2,304	1.76		
		435.44	
4,020	1.10		
		434.34	
2,060	1.38		
		432.96	
2,906	1.74		
		431.22	
3,810	1.40		
		429.82	
2,930	.65		
		429.17	Mouth of Big Creek.
2,920	4.35		
		424.82	
1,598	1.11		
		423.71	
1,790	1.03		
		422.68	
1,412	.32		
		422.36	
2,792	1.00		
		421.46	Mouth of Middle Creek.
1,618	.71		
		420.65	
2,138	1.33		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Continued.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		419.32	
4,664	1.92		
		417.40	
1,314	1.77		
		415.63	
1,720	1.05		
		414.58	
1,070	2.25		
		412.33	
804	.92		
		411.41	
1,710	.20		
		411 21	
1,436	.20		
		411.01	
2,394	.80		
		410.21	Mouth of Leatherwood Creek.
2,666	2.30		
		407.91	
3,268	1.30		
		406.61	Mouth of Cow Creek.
1,960	1.70		
		404.91	Cow Creek Shoal.
3,750	1.70		
		403.21	
988	1.78		
		401.43	
1,734	.47		
		400.96	
1,322	1.24		
		399.72	
3,100	2.80		
		396.92	
2,760	.60		
		396.32	
3,360	1.98		
		394.34	
2,776	.52		
		393.82	
1,856	1.50		
		392.32	
3,246	1.88		
		390.44	
4,230	1.60		
		388.84	
3,060	1.35		

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Elevations of water surface of Buffalo Fork of White River, Arkansas, above sea-level at Gulf, from Boxley to mouth of river.—Concluded.

Distance Feet	Difference in elevation Feet	Corrected elevation Water surface Feet	Remarks
		387.49	
1,482	.64		
		386.85	Water surface of White River. Total distance from Boxley, 691,864 ft. or 131+ miles. Total fall from Boxley, 686.18 ft. Average fall per mile, 5.23 ft.
2,548	+1.07		
		387.92	
1,358	+8.25		
		396.17	
92	+13.40		
		409.57	
80	+13.60		
		423.17	
714	—1.85		
		421.32	
640	—.80		
		420.52	
464	+3.06		
		423.58	
1,120	+2.00		
		425.58	
252	—.68		
		424.90	U. S. G. S. B. M., elevation, 422.31 ft. at Buffalo City. Monument 5 in. by 5. in. limestone, 5 in. above ground, on the right bank of the river, about 500 ft. above the old landing.

BUFFALO FORK OF WHITE RIVER.

Buffalo Fork of White River, near Gilbert, Arkansas.

At this station, a standard chain gage, attached to the up-stream guard rail of the Missouri & North Arkansas Railroad bridge across the river, was installed July 16, 1909, by the Water Resources Branch of the United States Geological Survey. The chain measures 37.85 feet from the end of the weight to the lower marker, and 57.87 feet to upper marker. The location of this gage is referred to bench

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mark No. 1, southwest corner of the top of the left bridge abutment marked with black paint, "B. M."—elevation, 29.98 feet above zero of the gage—and to bench mark No. 2, southwest corner of left bridge pier, marked with black paint, "B. M."—elevation, 50.06 feet—above zero of the gage.

Buffalo Fork of White River is about 140 miles long. It rises in the Boston Mountains and flows in an easterly direction, emptying into White River a few miles below Buffalo City. The river is divided, in Sec. 21, T. 16 N., R. 20 W., into two nearly equal prongs, Little Buffalo entering from the south. Buffalo Fork of White River drains about 1,383 square miles. The country through which this stream flows is very rough and broken. It is well timbered, with no swamp, or lake storage. The valley of the stream is very narrow, especially in the eastern part, with very little farm land. Most of the area is held as mining property, or timber land.

Buffalo Fork of White River above mouth of Little Buffalo. Flow measurements taken July 26, 1910, in Sec. 8, T. 16 N., R. 20 W., on the main prong of Buffalo Fork above the mouth of Little Buffalo, gave a flow of 85.19 cubic feet per second. Basing the calculations on this one measurement of the flow, and the fall of 323 feet from Boxley to the mouth of Little Buffalo, there was available at the date given, about 2,495 horsepower on the main fork of the river. No work was done on Little Buffalo.

Buffalo Fork of White River below mouth of Little Buffalo. Between the mouth of Little Buffalo and Gilbert, a distance of 46 miles by river, there is a fall of about 199 feet. Using flow measurements obtained at Gilbert as a basis for calculations, on the assumption that the above fall would be made available, the following table shows the possible horsepower:

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Table of available horsepower between the mouth of Little Buffalo and Gilbert.

Flow in second-feet at Gilbert		Horsepower		
Minimum	Maximum	Minimum	Maximum	Average of Minimum and Maximum
62	12,682	1,121	229,448	115,284

Buffalo Fork of White River at Mouth. From Gilbert to the mouth of the river, a distance of some 52 miles, there is a fall of about 162 feet. Basing our calculations on this fall, and the flow as found at Gilbert, the following table shows the available horsepower:

Table of available horsepower between Gilbert and the mouth of Buffalo Fork.

Flow in second-feet at Gilbert		Horsepower		
Minimum	Maximum	Minimum	Maximum	Average of Minimum and Maximum
62	12,682	913	186,771	93,842

Buffalo Fork of White River at Seven-mile Bend. At a point in Sec. 13, T. 17 N., R. 15 W., there is a fall of approximately 20 feet in 7 miles. The river makes almost a complete loop in this distance, coming back to within about 2,600 feet of the starting point. If a tunnel were driven through the hill which separates the channels at the narrowest point of the neck, and a 20-foot dam constructed at the upper entrance to the tunnel, making an available fall of 40 feet, this site would be made to yield 225 minimum horsepower, if we assume the minimum flow recorded at Gilbert. If means were provided for regulating the flood waters and averaging the flow, much more power would be available.

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Daily gage hight, in feet, of Buffalo Fork of White River, near Gilbert, Arkansas, for part of 1909-1910. Observer, Mrs. Esther Williams.—Continued.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1909												
1	.....	.....	.....	.....	.....	.....	.....	2.6	2.2	2.2	2.5	3.0
2	.....	.....	.....	.....	.....	.....	.....	2.6	2.2	2.2	2.4	3.0
3	.....	.....	.....	.....	.....	.....	.....	2.5	2.2	2.2	2.4	3.8
4	.....	.....	.....	.....	.....	.....	.....	2.5	2.2	2.2	2.4	3.6
5	.....	.....	.....	.....	.....	.....	.....	2.5	2.3	2.2	2.4	3.6
6	.....	.....	.....	.....	.....	.....	.....	2.5	2.3	2.2	2.5	4.3
7	.....	.....	.....	.....	.....	.....	.....	2.6	2.3	2.2	2.5	4.8
8	.....	.....	.....	.....	.....	.....	.....	2.7	2.3	2.2	2.5	4.3
9	.....	.....	.....	.....	.....	.....	.....	2.7	2.3	2.6	2.6	4.0
10	.....	.....	.....	.....	.....	.....	.....	2.6	2.3	2.4	2.5	3.7
11	.....	.....	.....	.....	.....	.....	.....	2.6	2.3	2.3	2.5	3.6
12	.....	.....	.....	.....	.....	.....	.....	2.6	2.3	2.3	2.6	4.6
13	.....	.....	.....	.....	.....	.....	.....	2.5	2.3	2.3	2.6	5.1
14	.....	.....	.....	.....	.....	.....	.....	2.5	2.2	2.3	2.7	4.8
15	.....	.....	.....	.....	.....	.....	.....	2.5	2.3	2.3	2.7	4.5
16	.....	.....	.....	.....	.....	.....	3.0	2.5	2.3	2.3	2.9	4.2
17	.....	.....	.....	.....	.....	.....	3.0	2.5	2.2	2.3	3.9	4.0
18	.....	.....	.....	.....	.....	.....	2.9	2.4	2.2	2.3	4.1	3.7
19	.....	.....	.....	.....	.....	.....	2.8	2.4	2.2	2.3	3.9	3.6
20	.....	.....	.....	.....	.....	.....	2.8	2.4	2.2	2.3	3.6	3.4
21	.....	.....	.....	.....	.....	.....	2.7	2.4	2.3	2.3	3.4	3.9
22	.....	.....	.....	.....	.....	.....	2.7	2.3	2.3	2.3	3.3	3.3
23	.....	.....	.....	.....	.....	.....	2.7	2.3	2.3	2.3	3.2	3.2
24	.....	.....	.....	.....	.....	.....	2.7	2.3	2.3	2.3	3.1	3.2
25	.....	.....	.....	.....	.....	.....	2.7	2.3	2.3	2.3	3.1	3.2
26	.....	.....	.....	.....	.....	.....	2.7	2.3	2.3	2.3	3.0	3.1
27	.....	.....	.....	.....	.....	.....	2.6	2.2	2.3	2.3	3.0	3.1
28	.....	.....	.....	.....	.....	.....	2.6	2.2	2.3	2.3	2.9	3.0
29	.....	.....	.....	.....	.....	.....	2.6	2.2	2.3	2.3	2.9	3.0
30	.....	.....	.....	.....	.....	.....	2.6	2.2	2.3	2.3	2.9	2.9
31	.....	.....	.....	.....	.....	.....	2.6	2.2	2.3	2.3	.....	2.9

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Daily gage hight, in feet, of Buffalo Fork of White River, near Gilbert, Arkansas, for part of 1909-1910. Observer, Mrs. Esther Williams.—Concluded.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov	Dec.
1910												
1	2.9	3.2	7.0	3.2	3.6	4.7	4.1	3.0	3.2	....	....	....
2	2.9	3.1	6.3	3.2	3.5	4.6	4.4	2.9	3.3	....	....	....
3	2.9	3.1	5.7	3.2	3.5	4.4	7.3	3.0	3.3	....	....	....
4	2.9	3.1	5.2	6.6	3.4	4.2	6.7	2.8	3.2	....	....	....
5	2.9	3.0	4.9	9.3	3.4	4.4	7.3	2.8	3.2	....	....	....
6	3.2	3.0	4.7	8.1	3.3	4.4	6.3	2.9	7.2	....	....	....
7	3.8	3.0	4.4	6.7	3.3	4.2	5.5	4.2	7.0	....	....	....
8	3.7	2.9	4.2	5.9	3.3	4.1	5.0	7.0	5.2	....	....	....
9	3.6	2.9	4.0	5.8	3.3	5.5	4.6	6.1	4.6	....	....	....
10	3.5	2.8	4.2	5.2	3.3	8.4	4.4	9.3	4.2	....	....	....
11	3.5	2.8	4.9	5.0	3.3	8.3	4.1	6.7	3.9	....	....	....
12	3.4	2.8	4.8	5.0	3.3	7.5	7.2	5.7	3.7	....	....	....
13	3.4	2.8	4.6	5.2	3.2	6.3	9.0	5.1	3.6	....	....	....
14	3.4	2.8	4.5	5.2	3.1	5.7	6.7	5.3	3.5	....	....	....
15	3.4	2.8	4.2	10.0	3.1	5.1	6.0	15.3	3.4	....	....	....
16	3.4	2.8	4.1	8.0	7.7	4.7	5.3	7.1	3.3	....	....	....
17	3.4	3.6	4.0	7.5	18.4	4.4	4.8	5.8	3.2	....	....	....
18	3.5	3.1	3.9	6.7	11.5	4.2	4.5	6.9	3.1	....	....	....
19	4.0	3.0	3.8	6.7	8.4	4.1	4.2	10.3	3.1	....	....	....
20	4.1	2.9	3.7	5.6	7.3	4.0	4.0	7.3	3.0	....	....	....
21	4.2	2.9	3.5	5.1	6.7	3.9	3.8	6.3	3.0	....	....	....
22	4.0	3.0	3.6	5.0	6.1	3.8	3.6	5.5	2.9	....	....	....
23	3.9	3.4	3.6	4.7	7.0	3.6	3.6	4.9	3.1	....	....	....
24	3.8	4.0	3.4	4.5	10.3	3.6	4.2	4.5	3.1	....	....	....
25	3.7	4.1	3.4	4.3	8.2	4.1	4.1	4.2	3.0	....	....	....
26	3.6	4.0	3.4	4.2	7.7	4.0	3.8	4.0	2.9	....	....	....
27	3.5	7.0	3.3	4.1	7.0	4.5	3.6	3.8	3.1	....	....	....
28	3.4	8.05	3.3	4.0	6.2	4.5	3.4	3.6	3.1	....	....	....
29	3.3	.....	3.2	3.8	5.7	....	3.3	3.5	3.1	....	....	....
30	3.3	.....	3.2	3.7	5.3	....	3.2	3.4	3.0	....	....	....
31	3.2	.....	3.2	.....	5.0	....	3.1	3.2	....	....	....	....

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Discharge measurements of Buffalo Fork of White River, near Gilbert, Arkansas.

Date	Hydrographer	Width	Area of section	Mean velocity	Gage hight	Discharge.
1909		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Nov. 29	W. N. Gladson	65	98	1.34	3.0	131*
Dec. 23	W. N. Gladson	68	128	1.21	3.2	155*
1910						
May 22	W. N. Gladson	100	414	4.60	6.27	2,257†
May 23	W. N. Gladson	160	915	2.82	7.20	2,650‡
Aug. 1	W. N. Gladson	68	127	1.02	3.02	137.4*

*50 ft. above bridge.
†At railway bridge.
‡800 ft. above bridge.

Rating table for Buffalo Fork of White River at Missouri & North Arkansas Railway bridge, near Gilbert, Arkansas, from July 16, 1909, to October 1, 1910. —Continued.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
2.00	48		3.20	165		4.40	642	
		7			26			58
2.10	55		3.30	191		4.50	700	
		7			30			60
2.20	62		3.40	221		4.60	760	
		8			32			62
2.30	70		3.50	253		4.70	822	
		8			34			64
2.40	78		3.60	287		4.80	886	
		8			36			66
2.50	86		3.70	323		4.90	952	
		8			38			68
2.60	94		3.80	361		5.00	1020	
		9			39			70
2.70	103		3.90	400		5.10	1090	
		9			40			70
2.80	112		4.00	440		5.20	1160	
		9			44			72
2.90	121		4.10	484		5.30	1232	
		9			49			72
3.00	130		4.20	533		5.40	1304	
		15			53			74
3.10	145		4.30	586		5.50	1378	
		20			56			74

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Rating table for Buffalo Fork of White River at Missouri & North Arkansas Railway bridge, near Gilbert, Arkansas, from July 16, 1909, to October 1, 1910. —Concluded.

Gage hight	Discharge	Difference	Gage hight	Discharge	Difference	Gage hight	Discharge	Difference
5.60	1452		7.80	3354		9.90	5202	
		76			88			88
5.70	1528		7.90	3442		10.00	5290	
		78			88			88
5.80	1606		8.00	3530		10.10	5378	
		81			88			88
5.90	1687		8.10	3618		10.20	5466	
		83			88			88
6.00	1770		8.20	3706		10.30	5554	
		88			88			88
6.10	1858		8.30	3794		10.40	5642	
		88			88			88
6.20	1946		8.40	3882		10.50	5730	
		88			88			88
6.30	2034		8.50	3970		10.60	5818	
		88			88			88
6.40	2122		8.60	4058		10.70	5906	
		88			88			88
6.50	2210		8.70	4146		10.80	5994	
		88			88			88
6.60	2298		8.80	4234		10.90	6082	
		88			88			88
6.70	2386		8.90	4322		11.00	6170	
		88			88			88
6.80	2474		9.00	4410		11.10	6258	
		88			88			88
6.90	2562		9.10	4498		11.20	6346	
		88			88			88
7.00	2650		9.20	4586		11.30	6434	
		88			88			88
7.10	2738		9.30	4674		11.40	6522	
		88			88			88
7.20	2826		9.40	4762		11.50	6610	
		88			88			88
7.30	2914		9.50	4850		11.60	6698	
		88			88			88
7.40	3002		9.60	4938		11.70	6786	
		88			88			88
7.50	3090		9.70	5026		11.80	6874	
		88			88			88
7.60	3178		9.80	5114		11.90	6962	
		88			88			88
7.70	3266							
		88						

The above table is not applicable for ice or obstructed channel conditions. It is based on five discharge measurements made during November and December, 1909, and May and August, 1910, and is fairly well defined between gage hights 3 feet and 6 feet. Above gage hight 6 feet the rating curve is a tangent, the difference being 88 per tenth.

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Monthly discharge of Buffalo Fork of White River, near Gilbert, Arkansas, 1909-1910. (*Drainage area, 822 square miles.*)

Month	Discharge in Second-Feet				Run-off
	Maximum	Minimum	Mean	Per square mile	Depth in inches on drainage area
1909					
January	.....	.....	.....	.....	.....
February	.....	.....	.....	.....	.....
March	.....	.....	.....	.....	.....
April	.....	.....	.....	.....	.....
May	.....	.....	.....	.....	.....
June	.....	.....	.....	.....	.....
July	.....	.....	.....	.....	.....
August	103	62	81	.098	.11
September	70	62	68	.082	.09
October	94	62	68	.082	.09
November	484	78	150	.182	.20
December	1,090	121	360	.447	.52
The period	1,090	62	145	.176	.99
1910					
January	533	121	246	.299	.34
February	3,574	112	384	.467	.49
March	2,650	165	651	.790	.91
April	5,290	165	1,735	2.11	2.35
May	12,682	145	1,046	2.48	2.86
June	3,882	145	963	1.17	1.31
July	4,410	145	1,122	1.36	1.57
August	9,954	112	1,591	1.93	2.23
September	2,826	121	414	.503	.56
October	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....
The Period	12,682	112	1,017	1.24	12.62

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Miscellaneous discharge measurements.

Date	Hydrographer	Width	Area of section.	Mean velocity	Gage hight	Discharge
1910		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 26	W. N. Gladson	64	49.8	1.56	3.8	85.19*
Aug. 22	W. N. Gladson	54	74.38	.56	3.6	43.60†
April 8	W. N. Gladson	36	94.4	1.59	.....	169.6 †
April 4	W. N. Gladson	36	94.4	1.73	.....	189.6 ‡
April 4	W. N. Gladson	36	94.4	1.74	.....	179.84‡
1909						
Aug. 1	W. N. Gladson	75	513.8	1.07	5.4¶	511.8**
Aug. 22	W. N. Gladson	100	336.5	.53	4.9¶	142.7††
Nov. 28	W. N. Gladson	310	18.26	1.53	6.8	2791.0‡‡

*Buffalo Fork of White River, Sec. 35, T. 16 N., R. 20 W.
†Buffalo Fork of White River, Sec. 8, T. 16 N., R. 20 W.
‡War Eagle Creek, near War Eagle Mill.
**White River, near Habberton, Ark.
††White River east of Rogers, Ark.
‡‡White River at Walls Ferry.
¶Beaver.

CONTROL OF FLOOD WATERS ON WHITE RIVER, NORTH FORK, AND BUFFALO FORK.

These streams are all subject to wide fluctuations of flow. The maximum variation in gage hight on White River at Cotter will be in the neighborhood of 34 feet. North Fork and Buffalo Fork are subject to almost, if not quite, as great fluctuations. Any development of power contemplating a constant supply from one of these streams must include the control of the flood waters. The fall created by any ordinary dam would be entirely obliterated during the period of extreme flood.

If the nature of the development is such that an occasional shut-down, for high water to pass, would not seriously interfere with the enterprise, these streams will furnish abundance of power. Dam sites are numerous, and real estate is not high. The development of the mining and timber interest of Newton, Searcy, Boone, Marion and Baxter counties should furnish a ready local market for considerable power, while the cotton growing districts are within easy reach of a practicable long-distance transmission line, which would furnish power for manufacturing the cotton at home.

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Table of net horsepower per foot of fall, with a turbine efficiency of 80 per cent for the minimum monthly discharge of North Fork of White River, near Henderson, Arkansas.

1909				1910			
Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days	Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days
Aug.	476	43.2	4	Jan.	722	65.6	7
Sept.	632	57.4	13	Feb.	632	57.4	7
Oct.	550	50.0	7	March	820	74.5	2
Nov.	632	57.4	1	April	722	65.6	1
Dec.	632	57.4	1	May	722	65.6	1
.....	.....	....	...	June	1,150	104.5	7
.....	....	....	...	July	1,150	104.5	7
.....	....	....	...	Aug.	722	65.6	1
.....	....	....	...	Sept.	476	43.2	2

Average minimum horsepower per foot of fall for 14 months, 65.1.

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Table of net horsepower per foot of fall, with a turbine efficiency of 80 per cent for the minimum monthly discharge of White River near Cotter, Arkansas.

1909				1910			
Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days	Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days
Aug.	456	41.4	4	Jan.	1,039	94.4	1
Sept.	300	27.2	1	Feb.	835	75.9	1
Oct.	300	27.2	8	March	1,473	133.9	1
Nov.	456	41.4	2	April	1,473	133.9	1
Dec.	968	88.0	1	May	1,800	163.6	1
.....	....	....	...	June	2,544	231.2	3
.....	....	....	...	July	2,413	219.3	1
.....	....	....	...	Aug.	1,473	133.9	1
.....	....	....	...	Sept.	1,039	94.4	3

Average for 14 months, 107.5 minimum horsepower per foot of fall.

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Table of net horsepower per foot of fall, with a turbine efficiency of 80 per cent for the minimum monthly discharge of Buffalo Fork of White River, at Gilbert, Arkansas.

1909				1910			
Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days	Month	Minimum discharge second-feet	Minimum net horsepower per foot of fall	Duration of minimum days
Aug.	62	5.6	5	Jan.	121	11.0	5
Sept.	62	5.6	9	Feb.	112	10.1	7
Oct.	62	5.6	8	March	165	15.0	3
Nov.	78	7.0	4	April	165	15.0	3
Dec.	121	11.0	2	May	145	13.1	2
.....	....	....	...	June	145	13.1	1
.....	....	....	...	July	145	13.1	1
.....	....	....	...	Aug.	112	10.1	2
.....	....	....	...	Sept.	121	11.0	2

Average minimum horsepower per foot fall for 14 months, 10.5 horsepower

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The following information was obtained from the U. S. Weather Bureaus. Summary of the climatological data for Arkansas:

Table of mean monthly precipitation; inches and hundredths.

Stations	Elevation feet	Length of record Years	January	February	March	April	May	June	July	August	September
Fayetteville..	1451	22	2.72	2.44	4.27	4.89	6.26	4.84	4.81	4.40	3.58
Mossville ...	....	15	4.14	3.02	6.72	5.24	7.56	5.89	5.68	3.75	4.40
Rogers.....	1385	18	2.55	1.87	3.82	4.31	6.22	4.58	4.59	3.59	3.50
Dodd City....	1175	28	2.87	3.28	4.34	3.91	5.92	4.40	4.98	3.97	3.76

Stations	Elevation feet	Length of record Years	October	November	December	Annual
Fayetteville..	1451	22	3.05	3.19	2.81	46.76
Mossville....	....	15	3.59	3.66	3.70	56.86
Rogers.....	1385	18	2.60	2.92	2.12	42.67
Dodd City...	1175	28	2.95	3.19	3.00	46.57

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Table of mean temperature in degrees Fahrenheit.

Stations	Elevati'n feet	Length of record Years	January	February	March	April	May	June	July	August	Sept.
Fayetteville.....	1451	18	35.4	38.2	48.6	58.8	66.5	73.7	77.4	76.3	71.2
Mossville.....	....	12	35.2	34.7	48.2	56.7	65.7	71.6	76.3	77.3	70.0
Rogers.....	1385	15	34.8	36.1	47.7	58.2	66.3	73.3	76.9	77.9	70.4
Dodd City.....	1175	24	35.1	37.9	49.1	60.3	67.6	76.0	80.0	77.9	71.6

Stations	Elevati'n feet	Length of record Years	October	Nov.	Dec.	Annual
Fayetteville.....	1451	18	60.4	48.4	39.4	57.9
Mossville.....	....	12	59.5	47.5	36.7	56.6
Rogers.....	1385	15	59.5	48.0	38.0	57.3
Dodd City.....	1175	24	60.2	47.6	39.5	58.6

STATE CONTROL OF WATER POWERS.

In general, the use of the waters of rivers in the State are subject to State control, whether the river be navigable or not, so long as commerce is not interfered with by such control. The riparian owner, according to common law principles, has a right also to a reasonable use of the water for domestic purposes, or for the development of power.

The Federal Government claims and exercises the right of sovereignty over navigable streams, for the purpose of regulating interstate commerce, but unless a riparian owner, it can lay no claim to the use of the water for any other purpose. As the unrestricted development of water power would interfere with commerce, the water power developments on navigable streams must be subject to the dictates of the Federal Government. There are, therefore, three parties interested in power development on navigable

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streams, the Federal Government, the State, and the riparian owner.

President Roosevelt vetoed two bills granting authority to private parties for the construction of dams across navigable streams, under existing Federal laws, stating that he would withhold his approval from all such bills unless they provided for a fee to be payed to the United States for the use of such streams.

The Hon. Knute Nelson, United States Senator from Minnesota, chairman of the Senate Committee on Commerce, presented the following argument against this doctrine:

"The President * * * has declared it to be his policy not to approve of any bill permitting the construction of a dam by private parties across a navigable stream; although due provision is made for the conservation of the stream for the purpose of navigation, unless the bill provides for the payment of a royalty, or compensation, to the United States for the use of the water of the stream for purposes other than navigation.

"This is a new departure from the policy heretofore pursued in respect to legislation authorizing the construction of such dams, and in view of this fact it becomes important to inquire whether the Government of the United States has the right to require compensation, for the use of water in such streams for purposes other than navigation.

"The common-law doctrine of England that a stream is not deemed to be a navigable water-course unless the tide ebbs and flows in it is not the law in this country. The question whether a water-course is a navigable stream is one of fact. If it is capable of being used for the purposes of trade and commerce in any mode, even for floating rafts of logs and timber, it is deemed to be a navigable stream.

"The title to the water of a navigable stream within the borders of a State is not in the Federal Government, but in the State; and title to the banks and bed of the stream, after

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the Federal Government has parted with its riparian lands, is either in the State or in the riparian owner, or both, according to the laws of the respective states. * * *

"The use of water in such a stream is a matter of state regulation and state control. In many of the states the common-law rule, as defined in the following language of Chancellor Kent, prevails, to-wit:

"'Every proprietor of lands on the banks of a river has naturally an equal right to the use of the water which flows in the stream adjacent to his lands, as it was wont to run (*currere solebat*), without diminution or alteration. No proprietor has a right to use the water to the prejudice of other proprietors above or below him unless he has a prior right to divert it, or a title to some exclusive enjoyment. He has no property in the water itself, but a simple usufruct while it passes along. *Aqua currit et debet currere ut currere solebat,* is the language of the law. Though he may use the water while it runs over his land as an incident to the land, he can not unreasonably detain it or give it another direction, and he must return it to its ordinary channel when it leaves his estate.'"

A number of states have recently enacted water-power laws and still others are investigating the subject. The law of the State of New York provides for a water-supply commission which is "authorized and directed to devise plans for the progressive development of the water powers of the State, *for public use under State ownership and control.*" It further directs that detailed plans for such development be presented in reports made to the Governor of the State. This commission, after one year's investigation under the guidance of a noted engineer, use the following language in its report:

"There are at this time opportunities for the State to acquire at a minimum cost the necessary lands and rights for the construction of large storage dams for the control of flood waters and for the development of water powers which can be made to yield generous returns to the people, if built, developed, and controlled by the State; but these same lands and rights will be in a short time, like our forests, rapidly increase in price in the hands of private and corporate ownership. These valuable sites, like all natural resources, where nature has stored up immense treasures, grow more valuable each year as population becomes denser and the demand for their use increases.

"We have only to look across our northern border to the Dominion of Canada to see how our mistakes in allowing private interests to acquire natural resources have been avoided by the statesmanship of the Dominion Government. Another lesson may be learned from the policy of the Federal Government in obtaining a revenue from the national forests."

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In Pennsylvania, a water-supply commission of five members was created and provision was made that no charter of a corporation for supplying water to the public, or for the development, storage, or transportation of water-power for commercial and manufacturing purposes shall be granted until the application has received the approval of the water-power commission.

Oregon has a law providing for granting franchises of waterpower by the State, and collecting fees therefor. This is a recent law made effective in May, 1909, and is as follows:

"Section 1. That all water within the State from all sources of water supply belong to the public;

"Sec. 2. That every person, firm, or corporation, except municipal corporation (hereinafter call the appropriator), who shall appropriate water after the passage of this act for the purpose of applying the same to the development of power shall, during the life of such appropriation as fixed herein, pay to the State of Oregon not less than 25 cents or more than $2 per annum in advance, on or before the 2d day of January of each year, for each and every horsepower represented by the said appropriation. The amount of the payment shall be determined by the board of control and adjusted from time to time, based upon the percentage of power appropriated which is put to beneficial use. For the purpose of this act a horsepower is hereby defined to be 550 pounds of water per second of time for each foot of available fall.

"Sec. 3. The appropriator shall pay to the board of control the fees required by Section 2 of this act, proportionate to the remainder of the current year, and no appropriation of water for power purposes shall be deemed complete until such payment of fees is made. Immediately upon the receipt of such fees the board of control shall pay them over to the state treasurer, taking his receipt therefor, who shall place the same in the general fund of the state treasury. On or before the 2d day of January of each year thereafter every appropriator of water for power purposes shall forward to the board of control the fees provided for in section 2 of this act.

"Sec 4. Upon the completion of the appropriation of water for power purposes, as now hereafter provided by law, and compliance with the provisions of this act, the appropriator thereof shall own and enjoy all of the uses thereof so long as he pays the annual fees therefor herein required, for a term not exceeding forty years from the date of appropriation, and shall have a preference right to appropriate such water under such conditions as may be prescribed by law at the expiration of such term of years, provided all fees have been paid. If any appropriator shall fail to pay any annual fee, or shall fail or refuse to renew the appropriation at its expiration, the State shall have a preference lien therefor prior to all other liens or claims, except for taxes, upon the improvements of the appropriator for developing and applying such appropriation of water and the real estate upon which the same are located, and upon notice from the board of control the attorney-general shall proceed to foreclose the lien and

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collect any unpaid fees in the same manner as other liens on real property are foreclosed, and the water shall be again subject to appropriation.

"Sec. 5. Any person, firm, or corporation who believes himself or itself injured in any material right by any decision of the board of control shall have the right of appeal from such decision to the circuit court of the county in which the proposed appropriation of water is situated.

"Sec. 6. In case the board of control is not created by law with power to supervise the appropriation, distribution, and use of the water of the State, then the duties imposed upon the board of control as prescribed by this act shall devolve upon and be assumed by the State engineer."

Other states, as Oklahoma, South Dakota, North Dakota, Utah, New Mexico, Idaho, and Nevada, have water-power laws, each one differing somewhat from the other, but all tending in the same direction, to prevent a final monopoly of one of the greatest sources of natural energy. Electrical transmission of energy is no longer an experiment, and is sure to play an important part in the future development of the nation. There is sufficient power in the rivers of Arkansas, if developed for the benefit of the State, or leased to private corporations at a reasonable rental to pay a large part, if not all, of the State's annual expenses.

This source of power is as yet almost untouched in Arkansas, and it would be comparatively easy for the State now to declare some fixed policy concerning its development and use. A little later private corporations will have acquired rights, and the problem will be more complicated.

The present session of our Legislature should consider the advisability of enacting suitable laws to protect the State's interests in this natural resource. In doing so, our State would do well to study the laws of other countries, such as France and Switzerland, which are pioneers along these lines. The right of eminent domain should be given, and if possible, right-of-way along public roads for transmission lines, under judicious restrictions. The object to be attained should be to get our water powers developed, and at the same time to safeguard the interests of the State against monopoly, or unreasonably long appropriation of a water power site, without a readjustment of fees.

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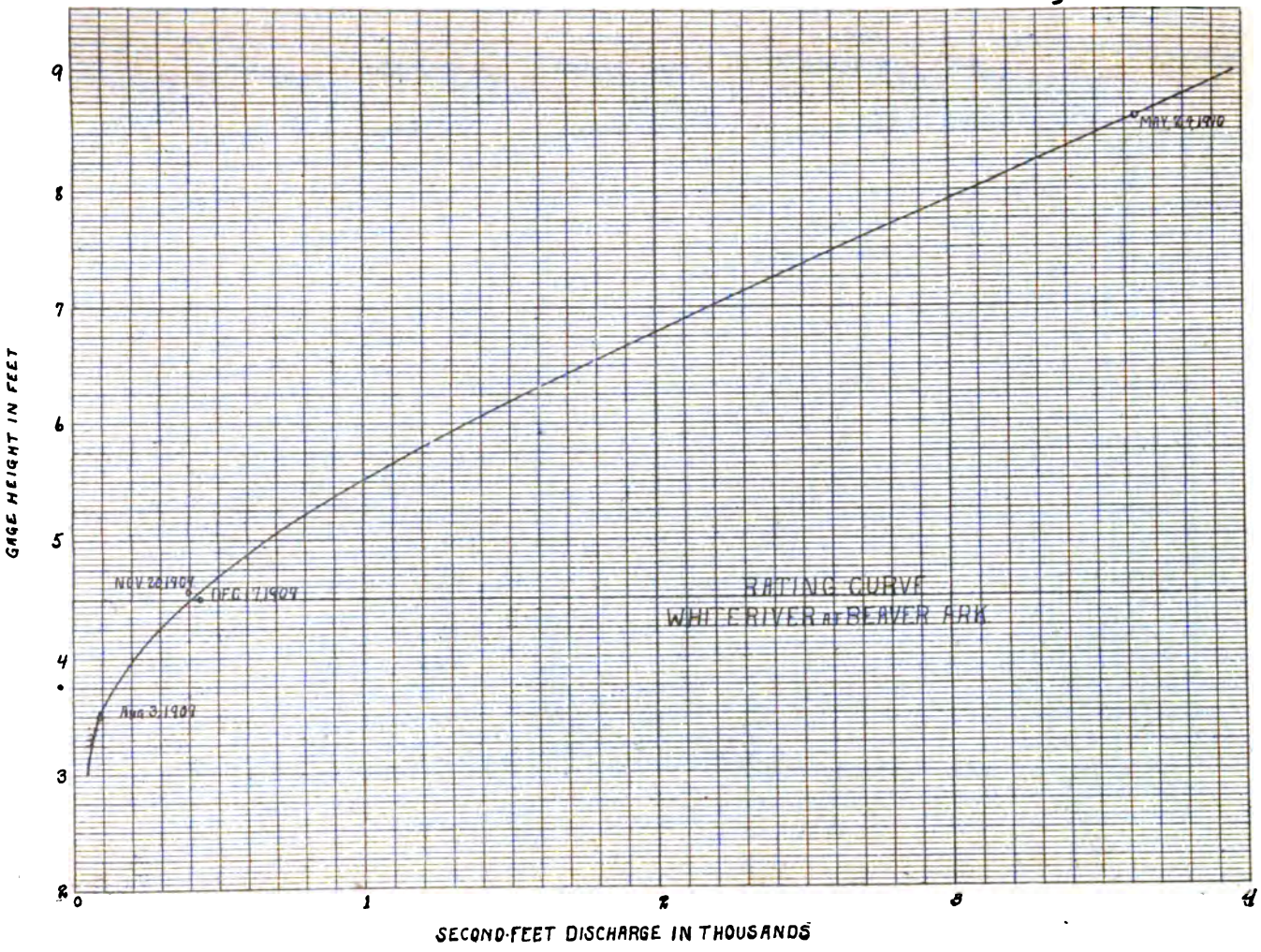

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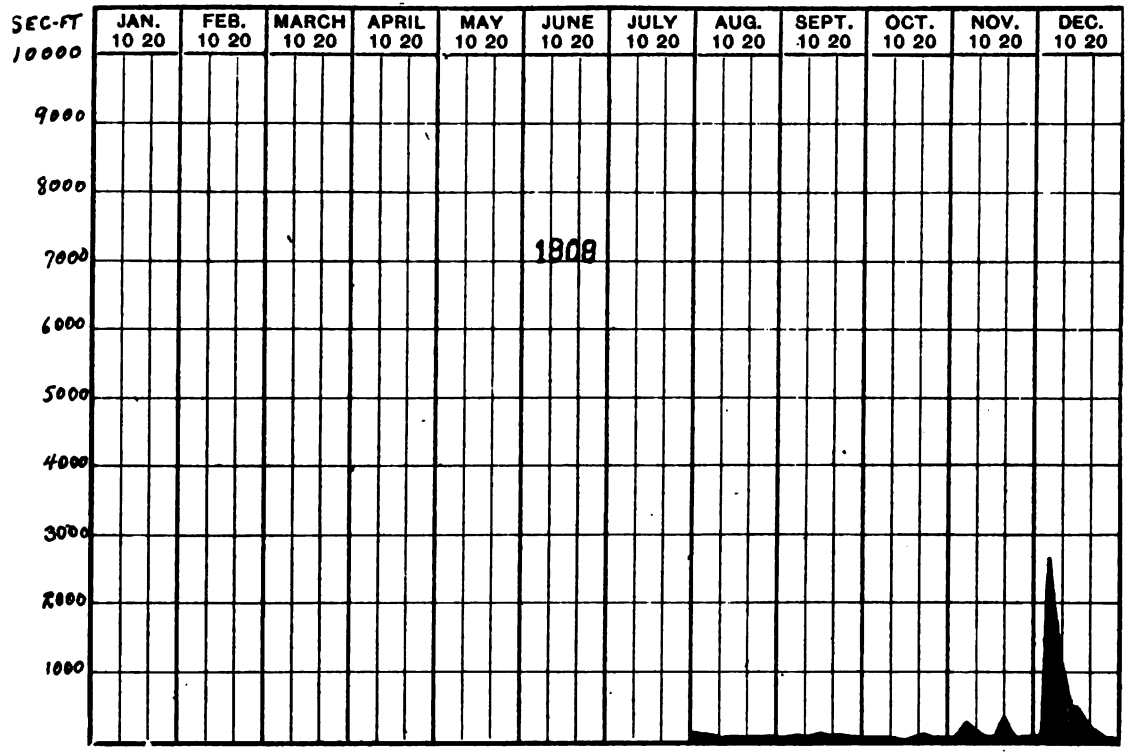

DISCHARGE OF WHITE RIVER AT BEAVER ARK. 1908.

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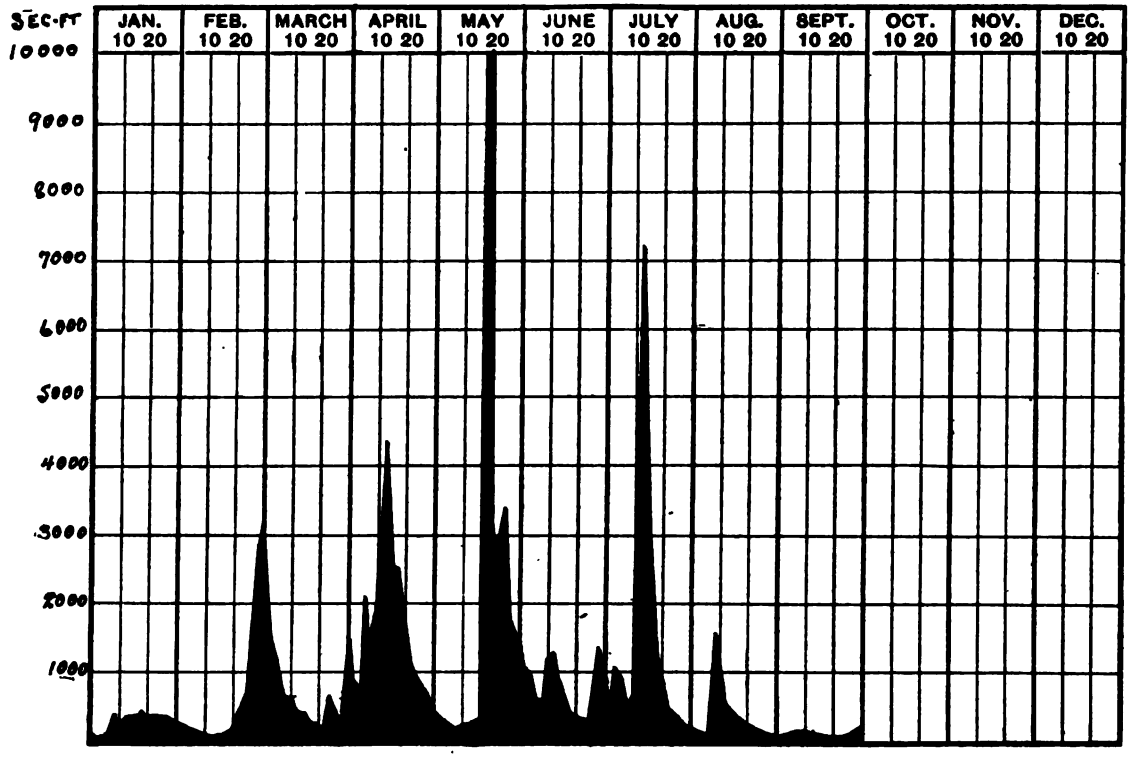
PLATE III



DISCHARGE OF WHITE RIVER AT BEAVER ARK. 1910.

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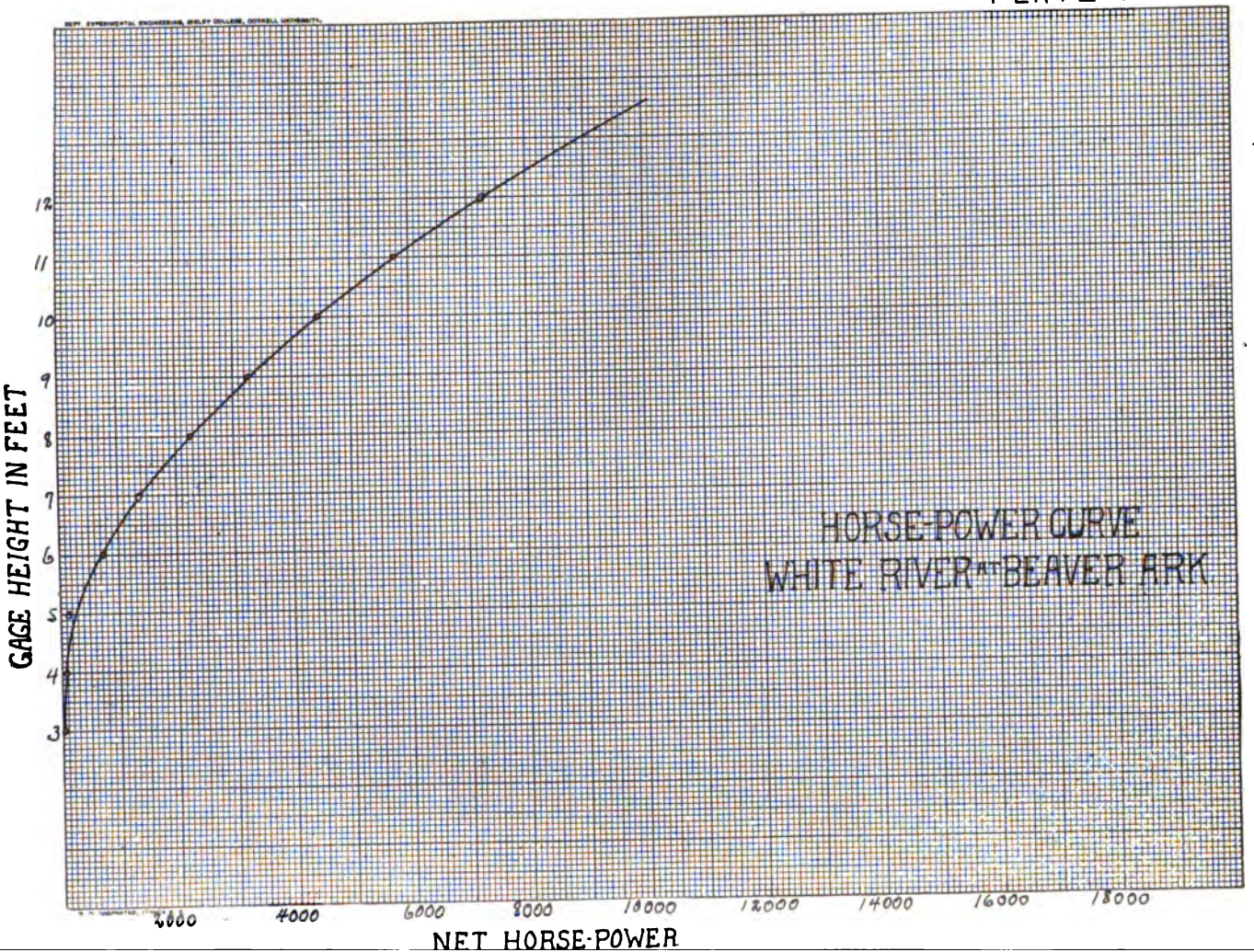

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PLATE V

SCENE ON UPPER WHITE RIVER

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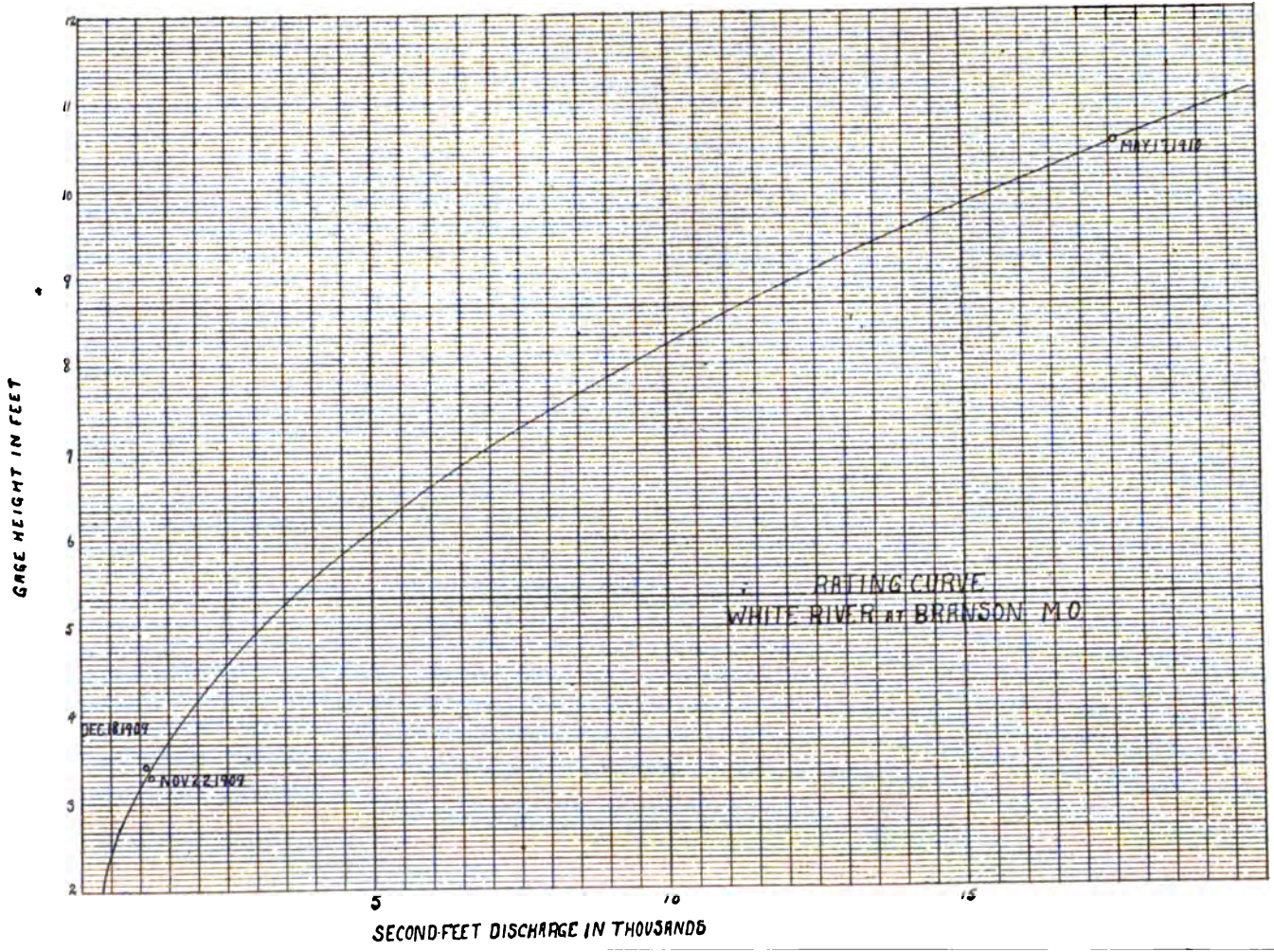
PLATE VI



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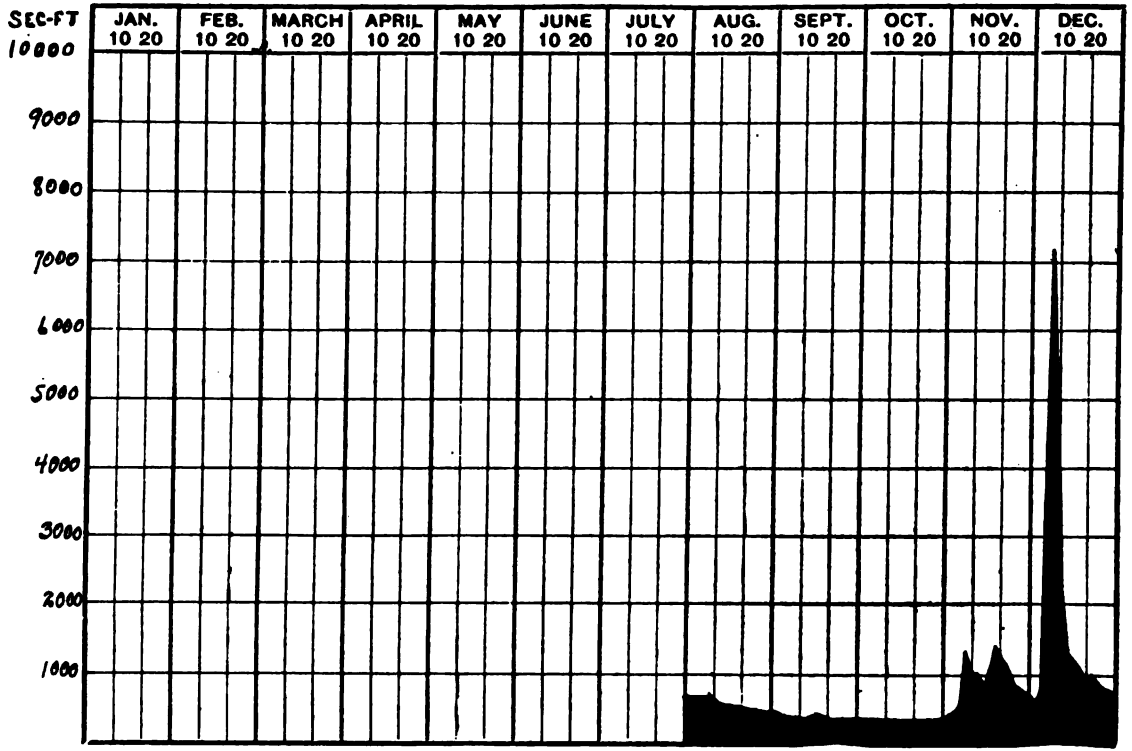

DISCHARGE OF WHITE RIVER NEAR BRANSON MO. 1908.

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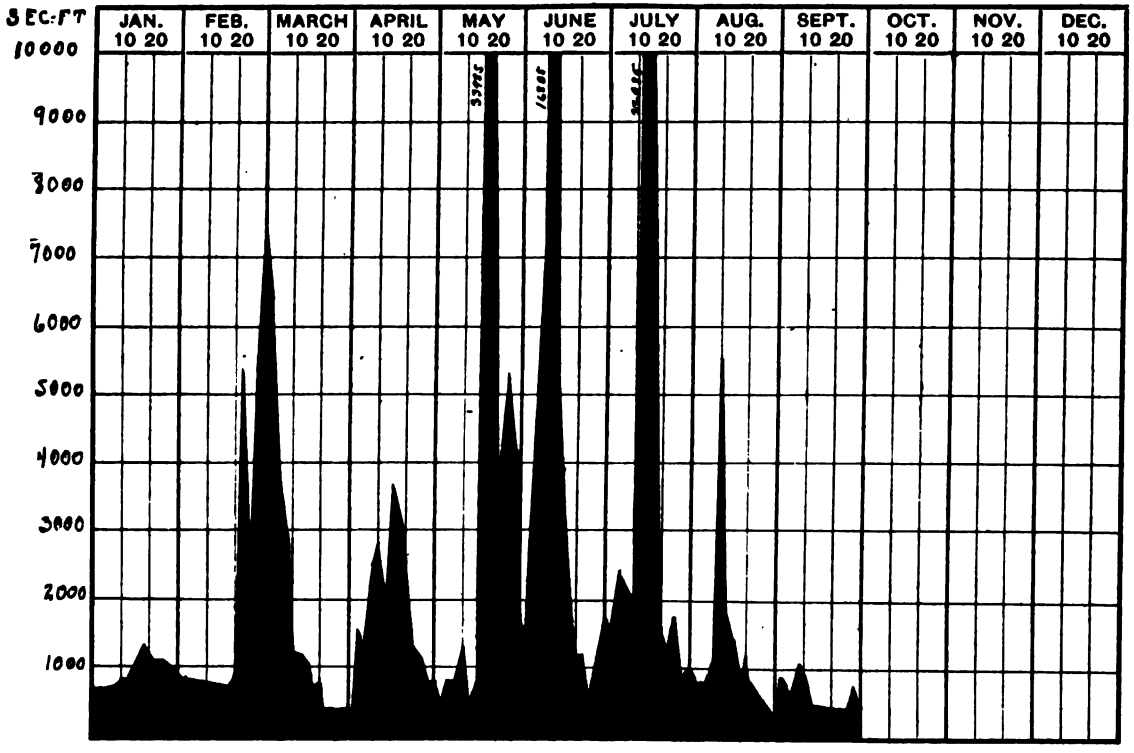
PLATE VIII



DISCHARGE OF WHITE RIVER NEAR BRANSON MO. 1910.

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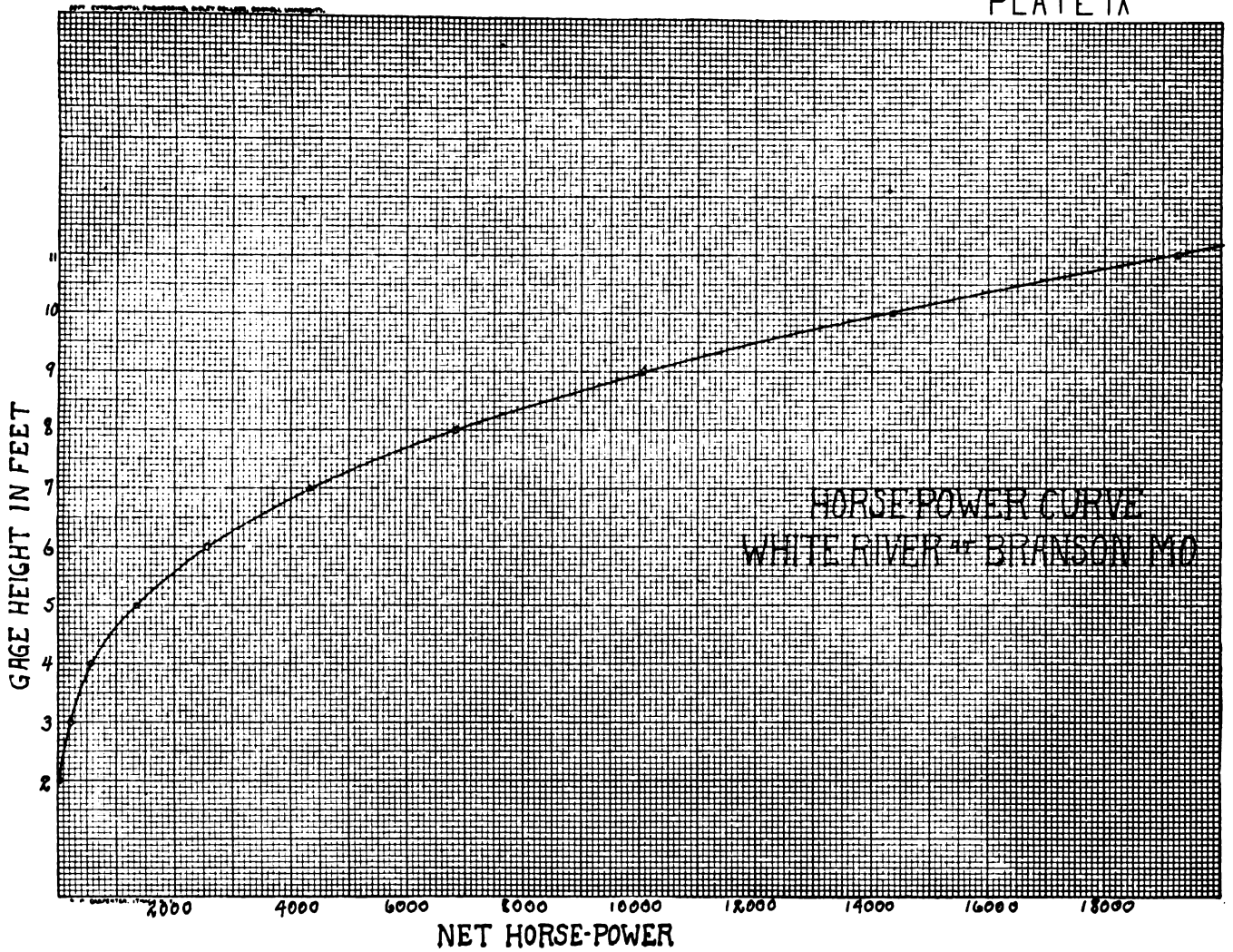

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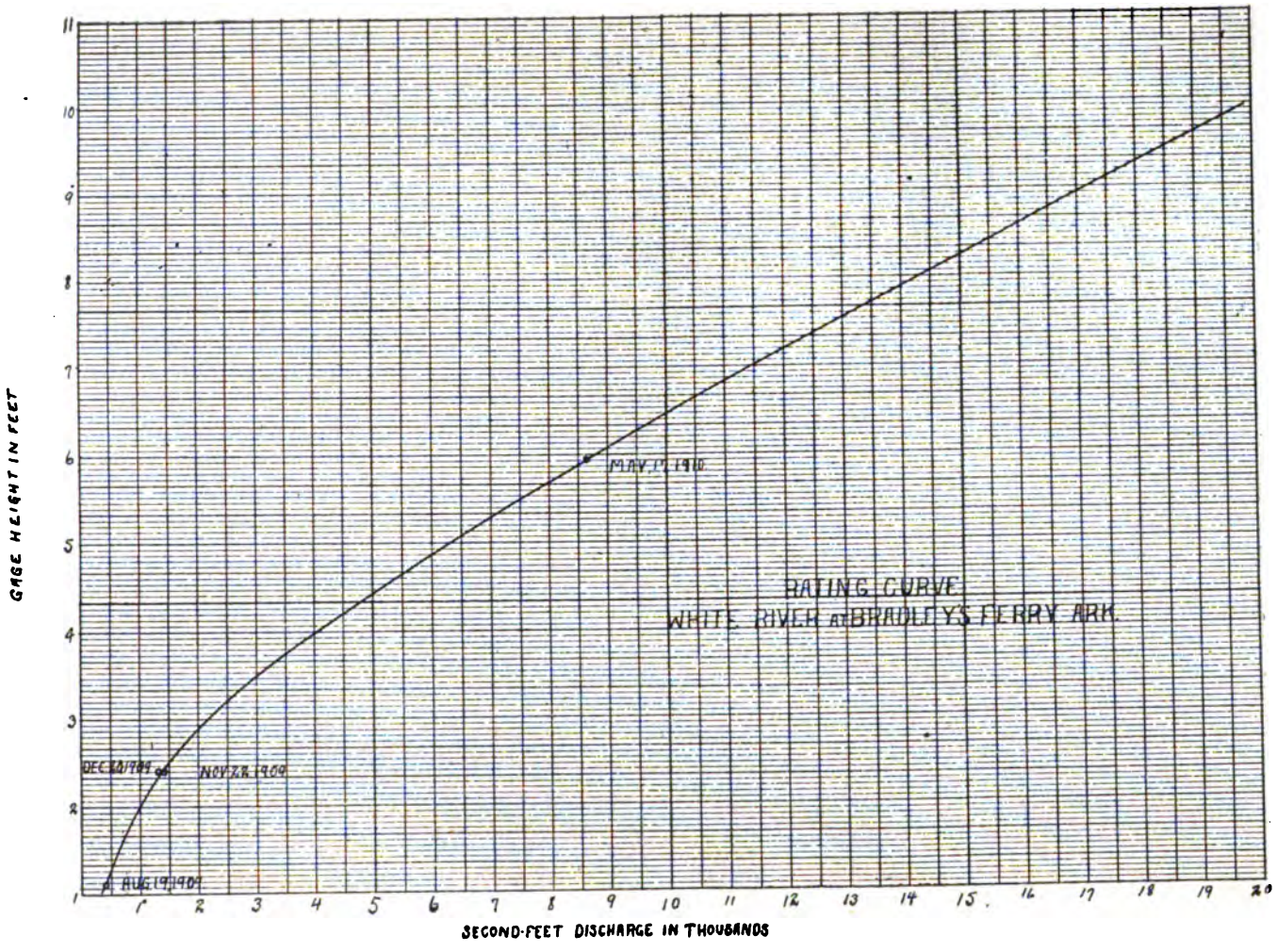

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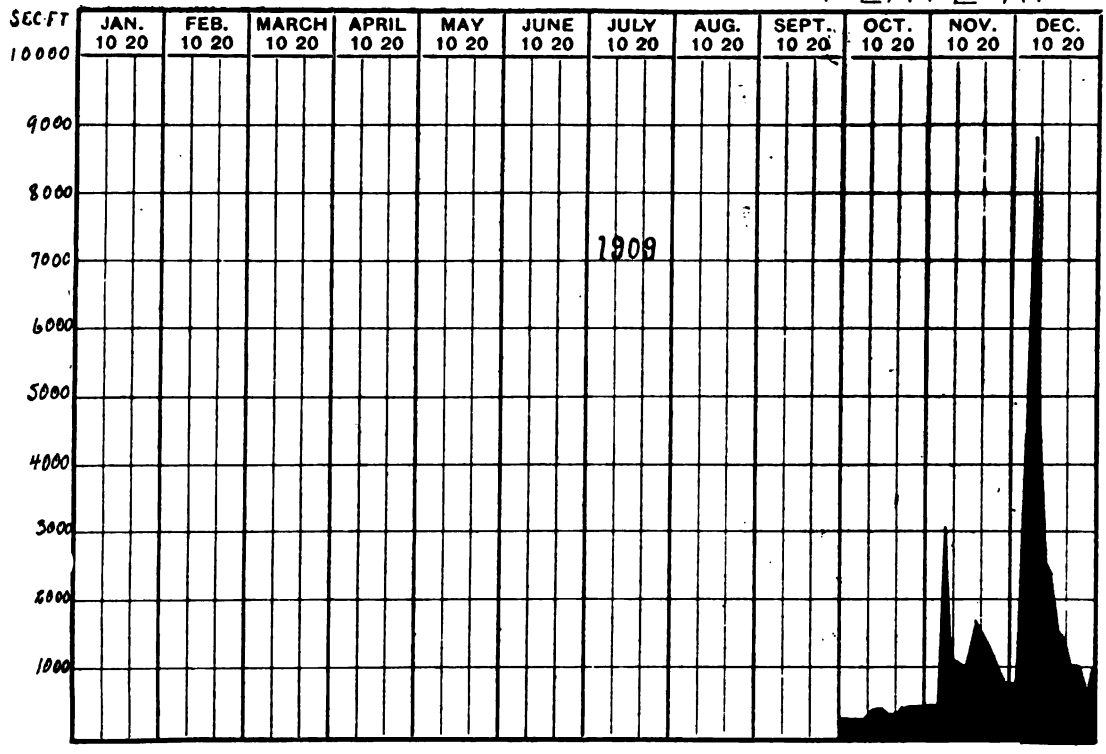

DISCHARGE OF WHITE RIVER NEAR LEAD-HILL ARK. 1908.

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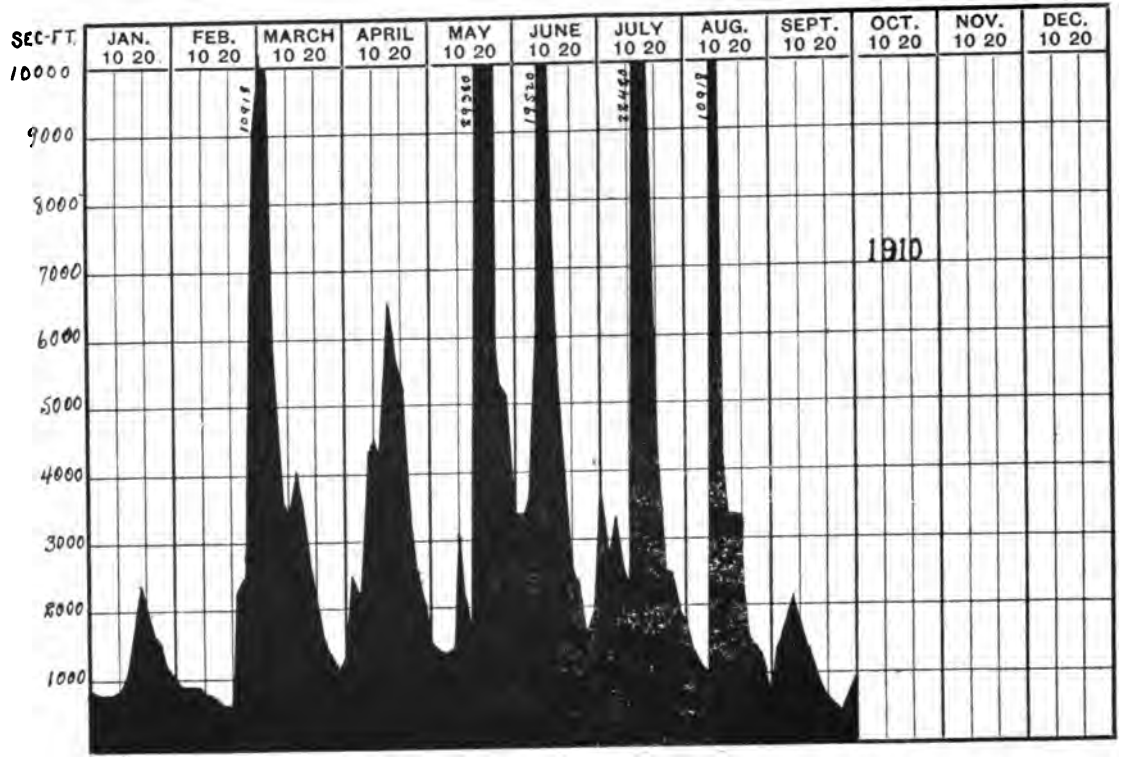

DISCHARGE OF WHITE RIVER NEAR LEAD HILL ARK. 1910.

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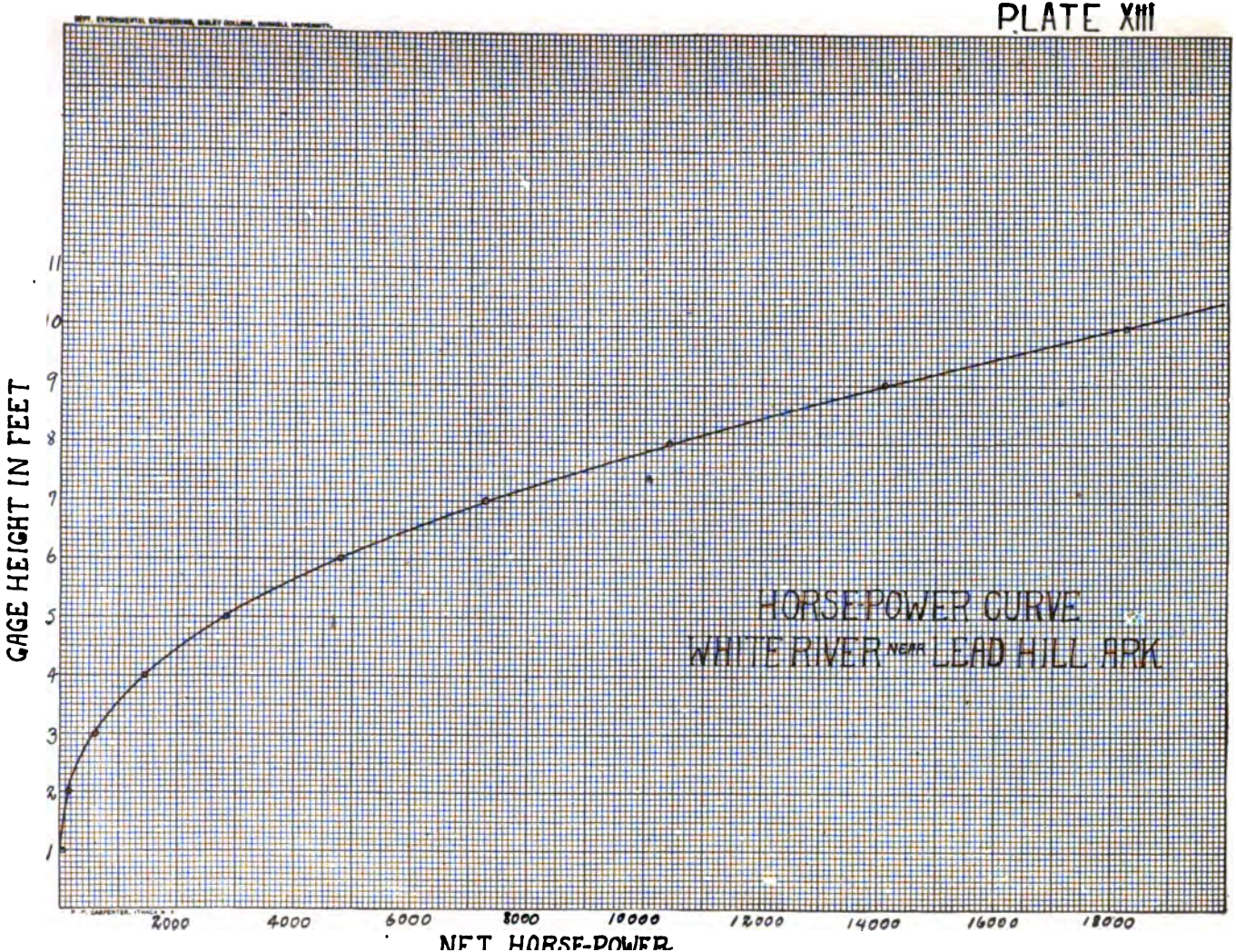

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PLATE XIV

SCENE ON WHITE RIVER, BOONE COUNTY

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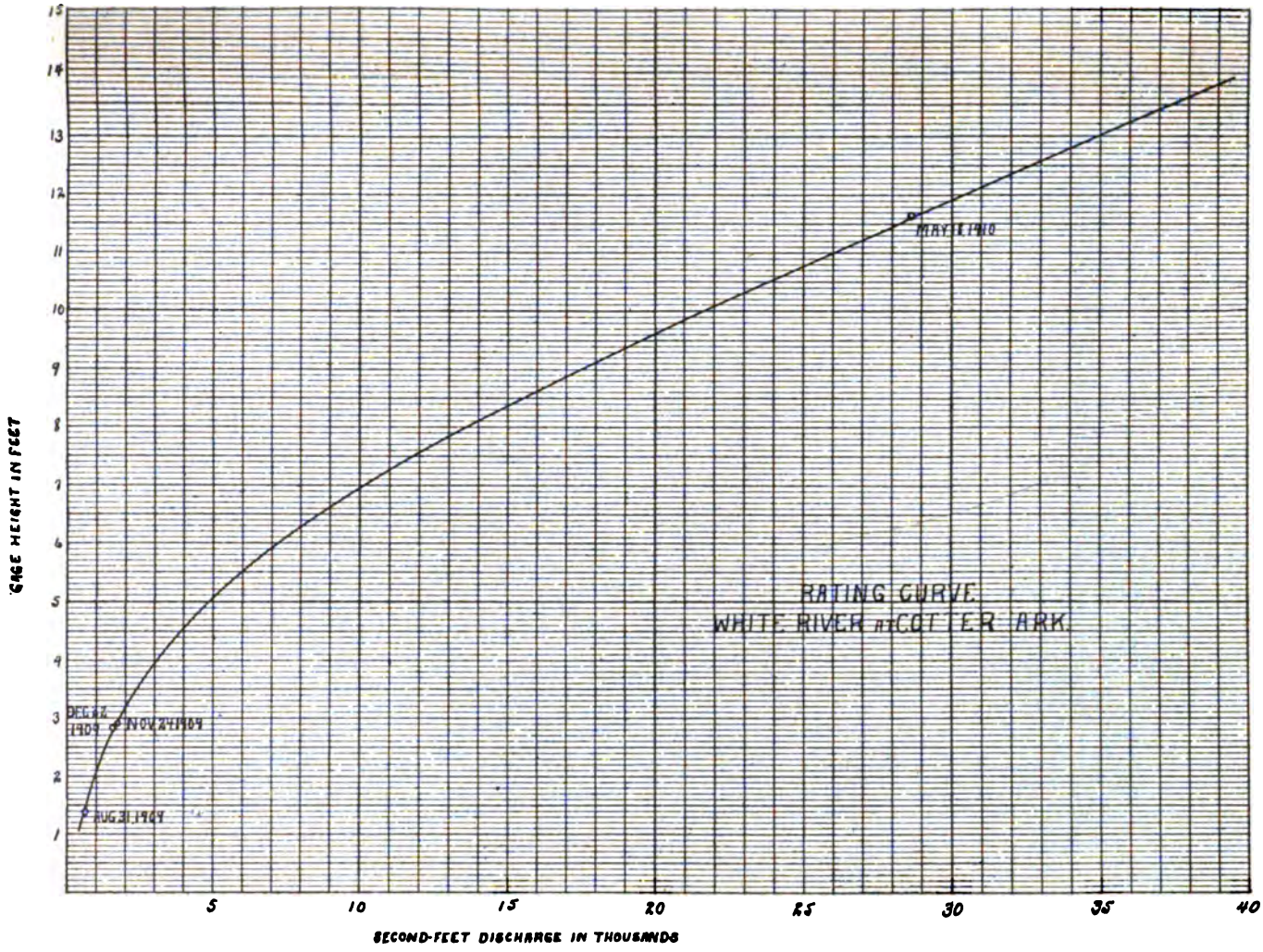
PLATE XV



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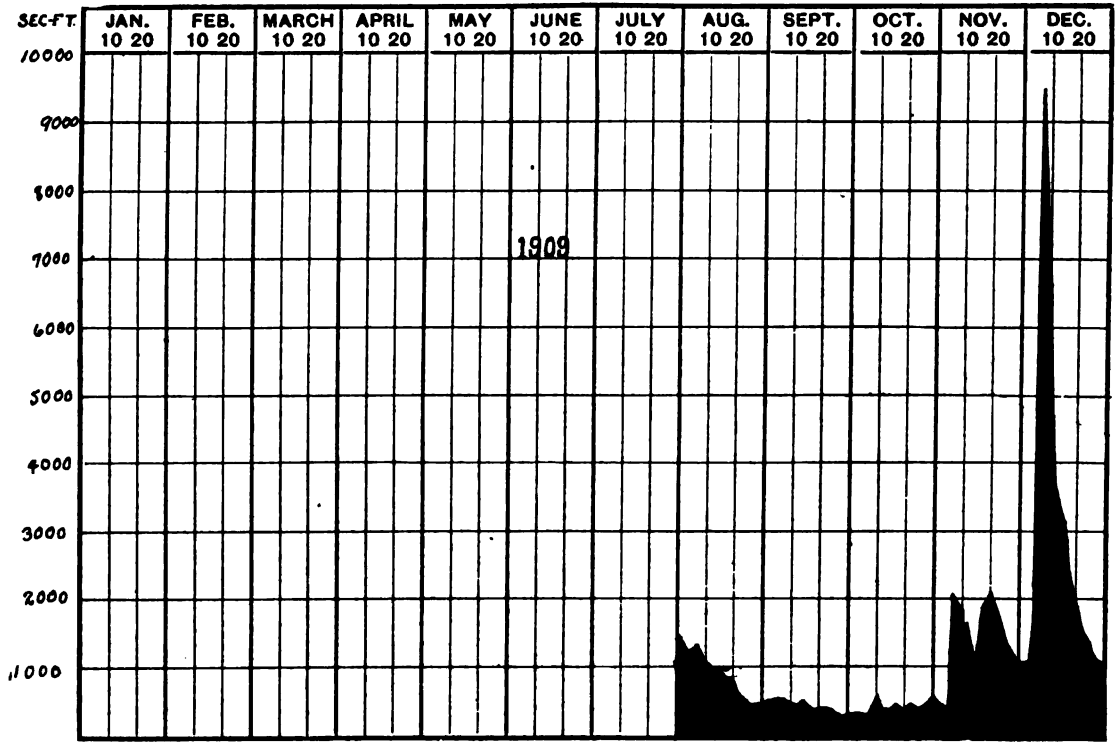

DISCHARGE OF WHITE RIVER AT COTTER ARK. 1909.

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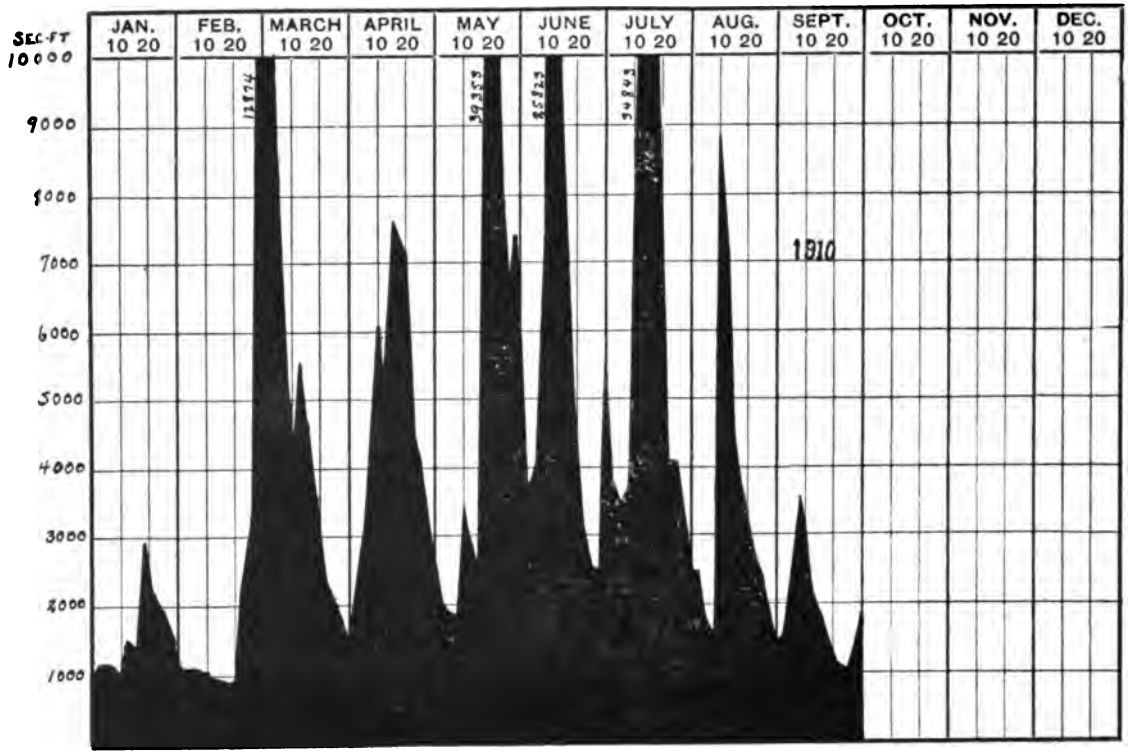
PLATE XVII



DISCHARGE OF WHITE RIVER AT COTTER ARK. 1910.

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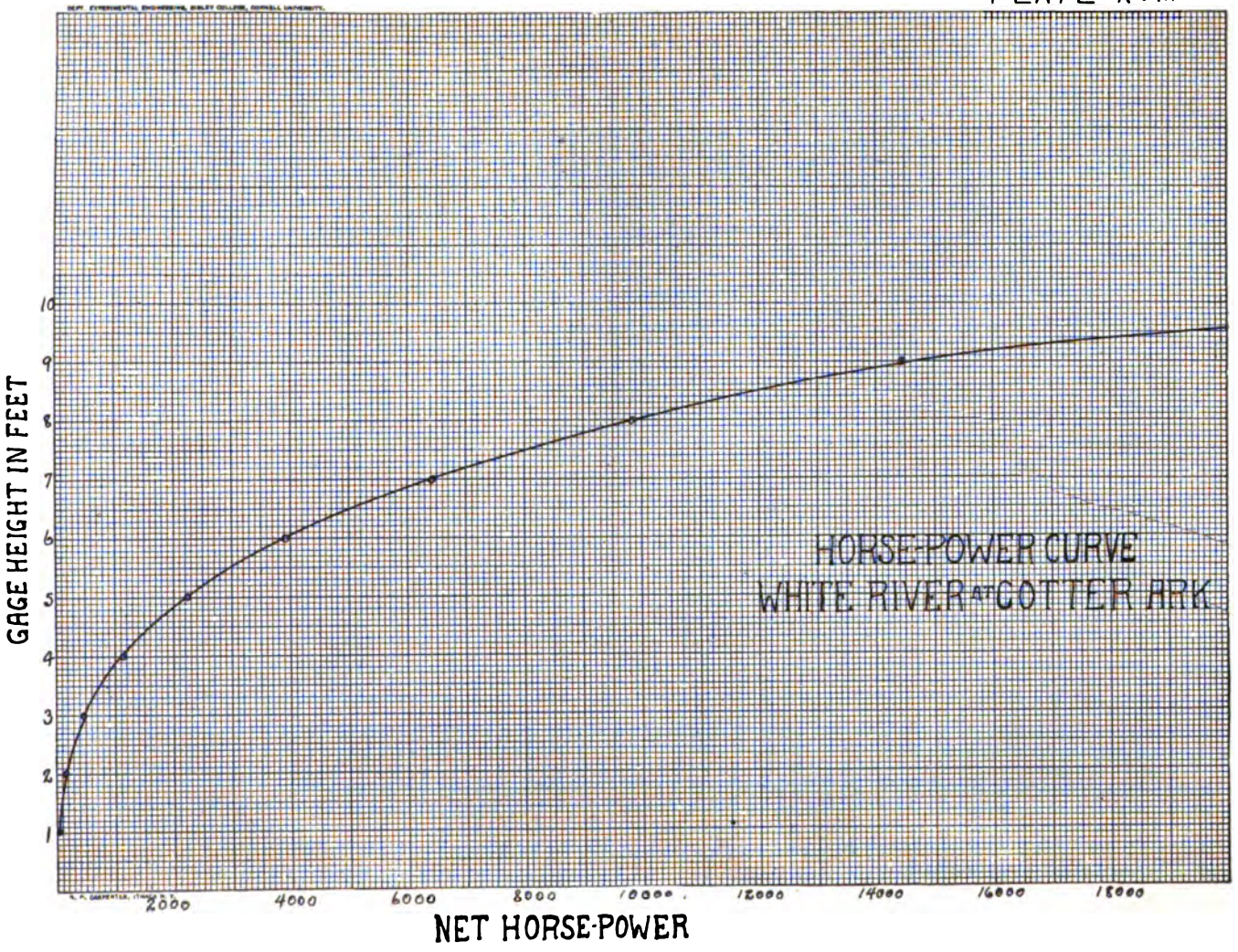
PLATE XVIII



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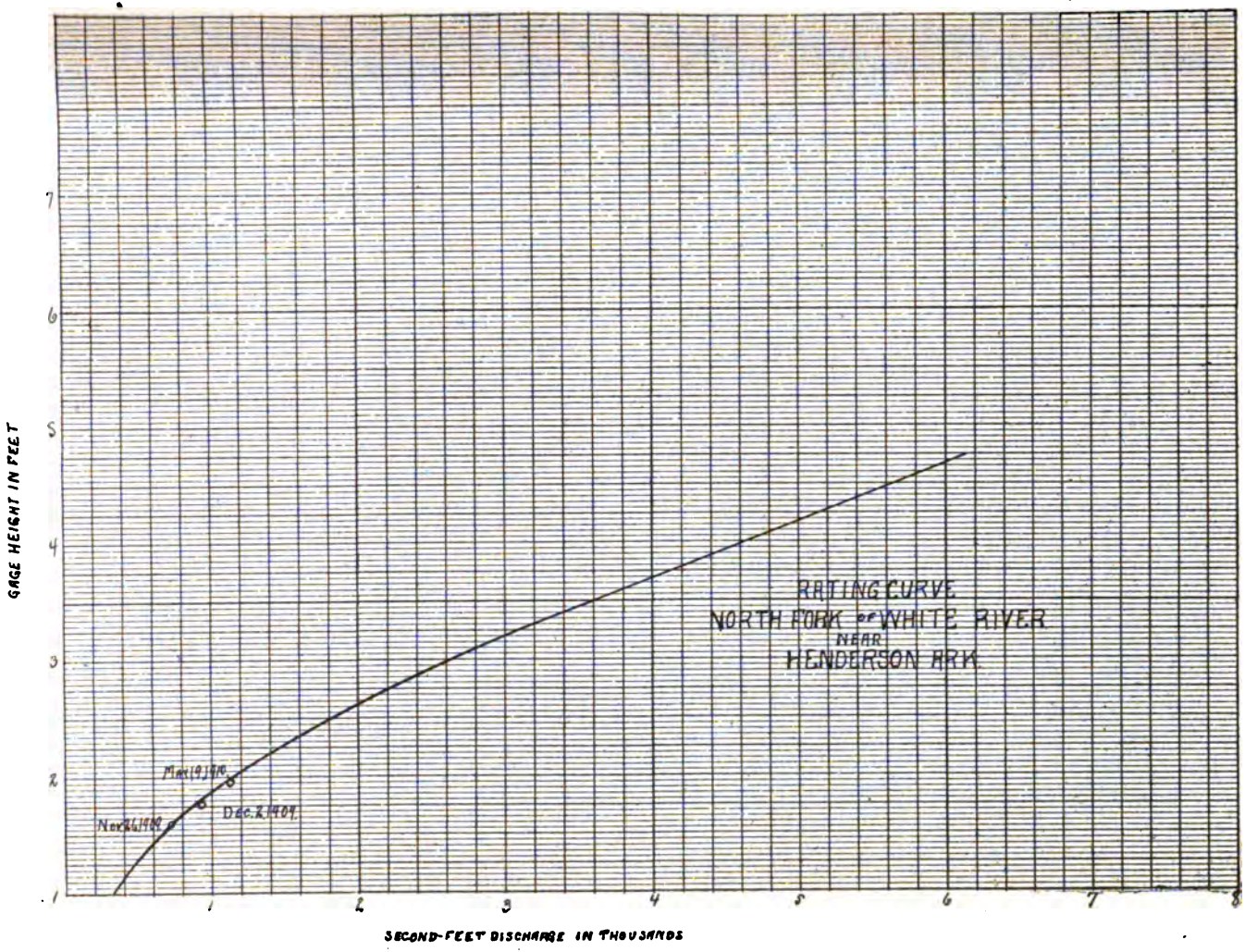

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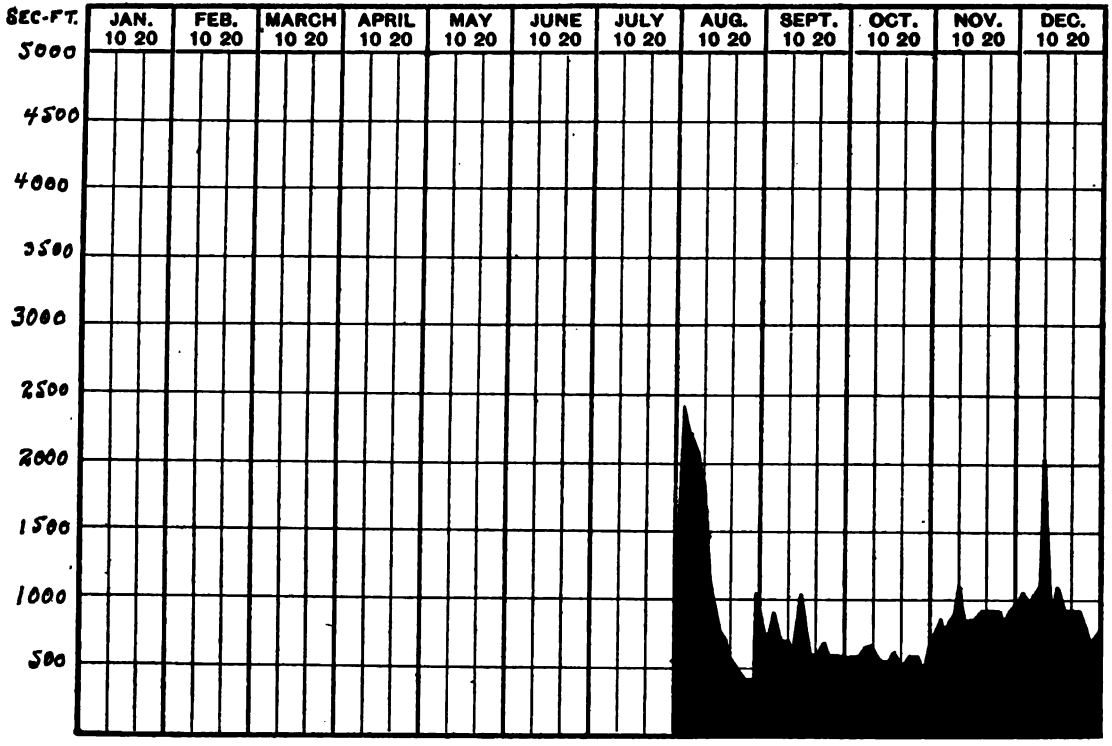

DISCHARGE OF NORTH FORK OF WHITE RIVER NEAR HENDERSON, ARK, 1909.

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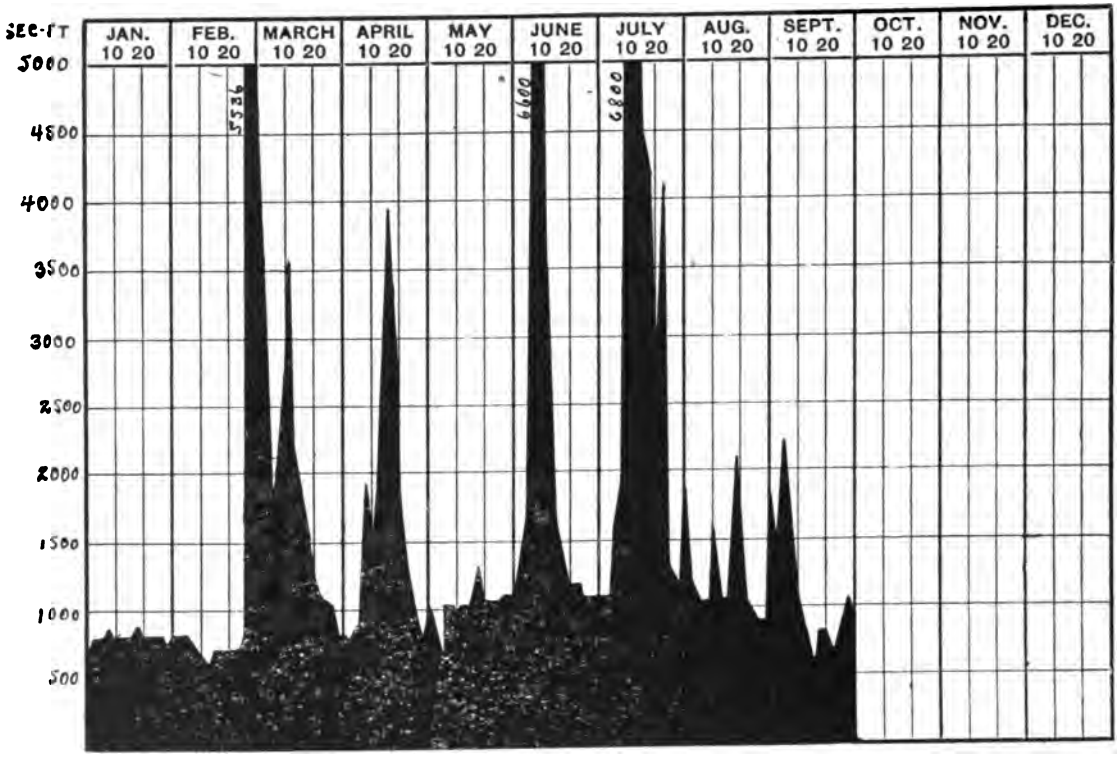
PLATE XXI



DISCHARGE OF NORTH FORK OF WHITE RIVER NEAR HENDERSON ARK 1910.

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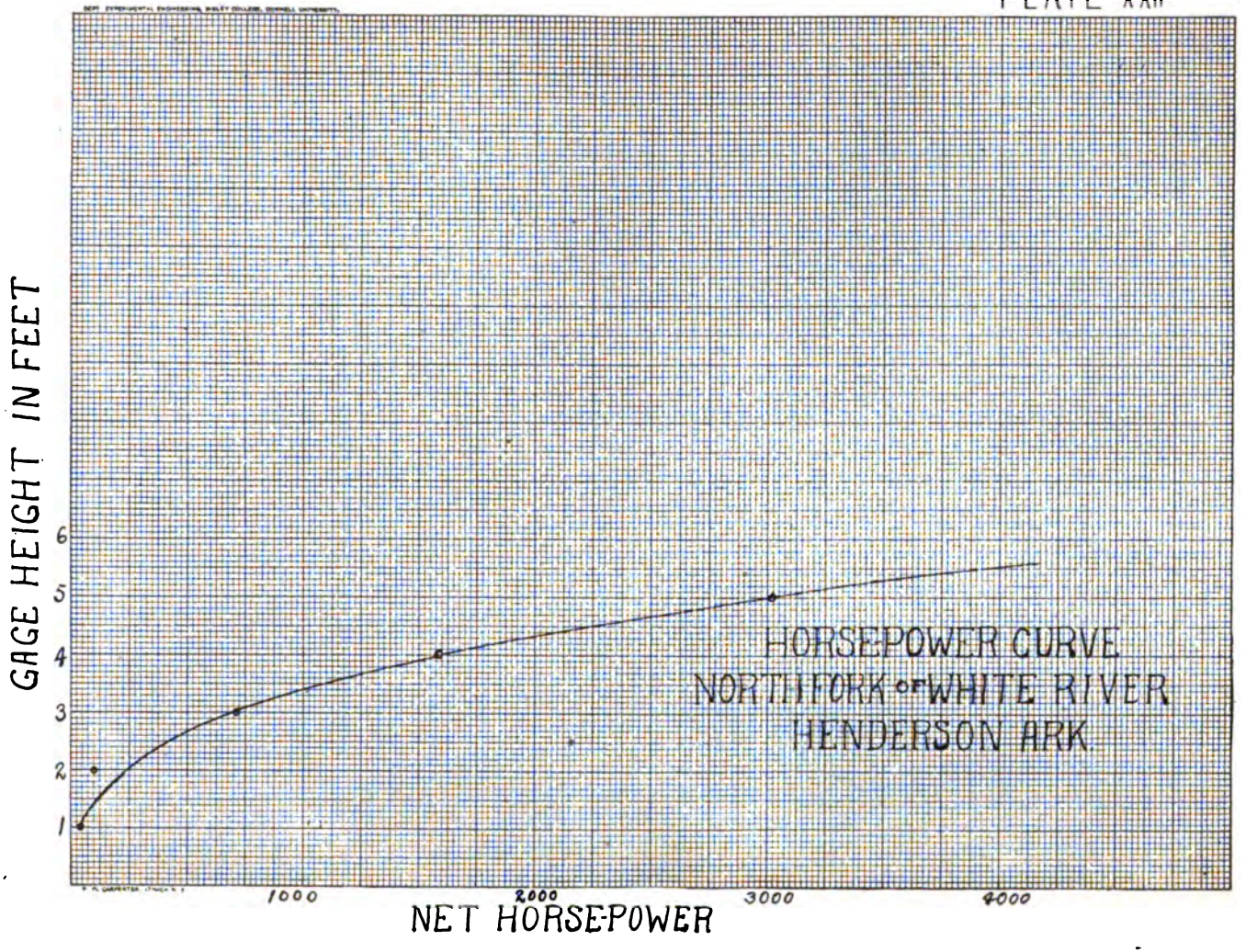

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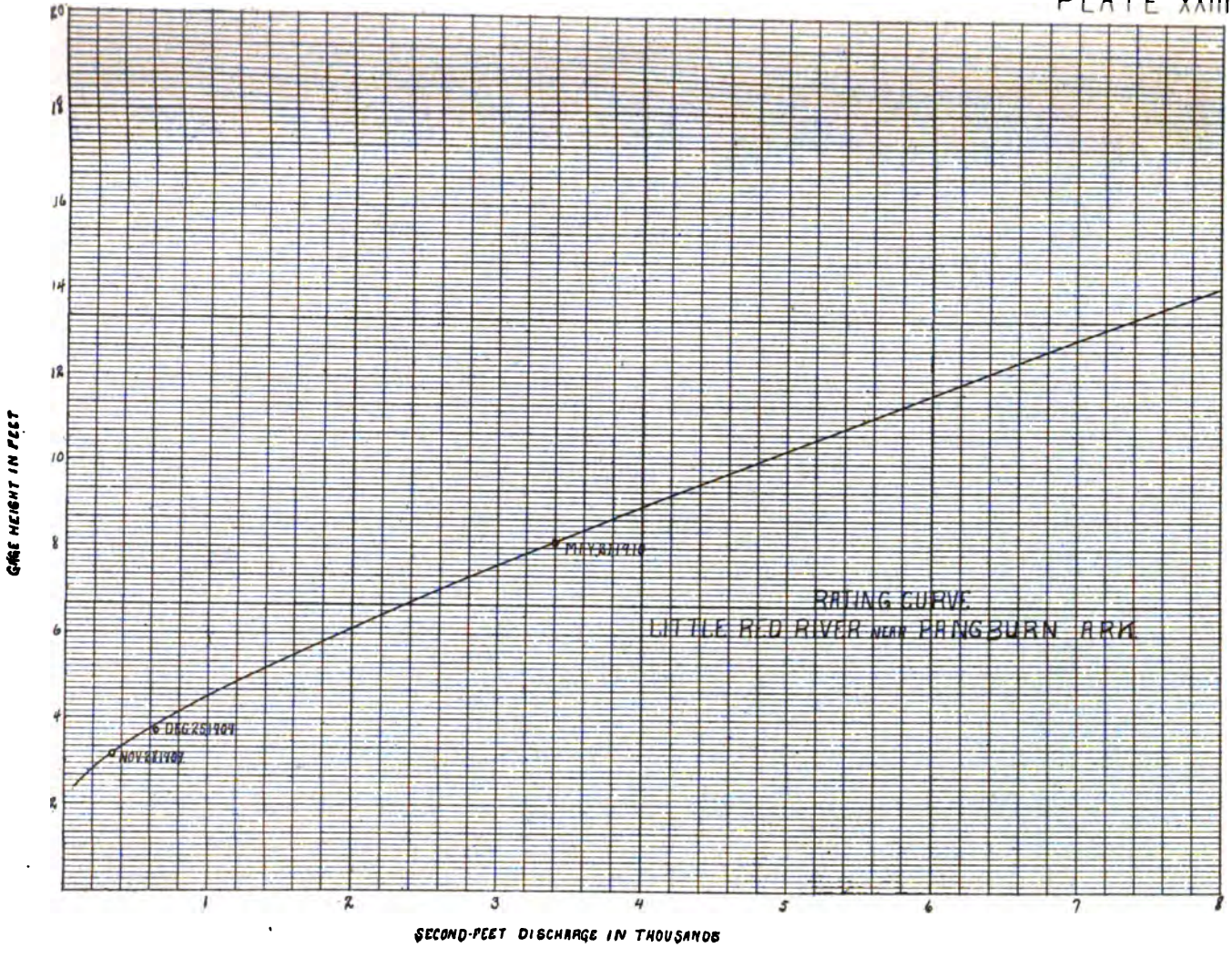

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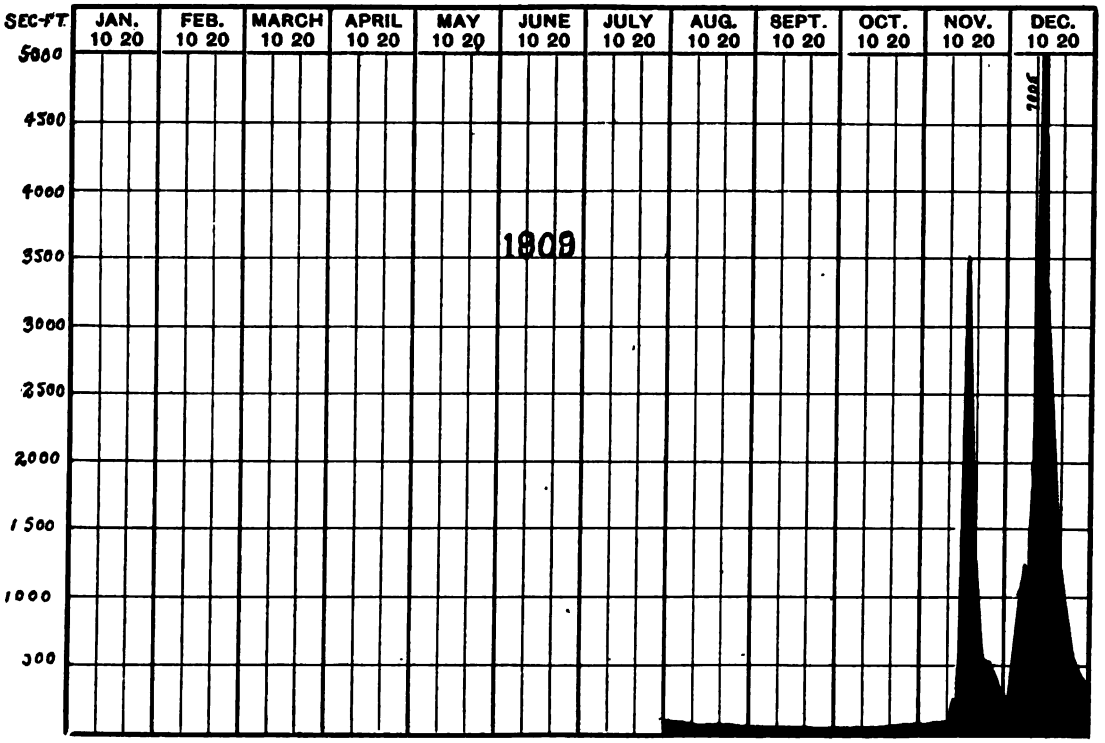

DISCHARGE OF LITTLE RED RIVER AT PANGBURN ARK 1909.

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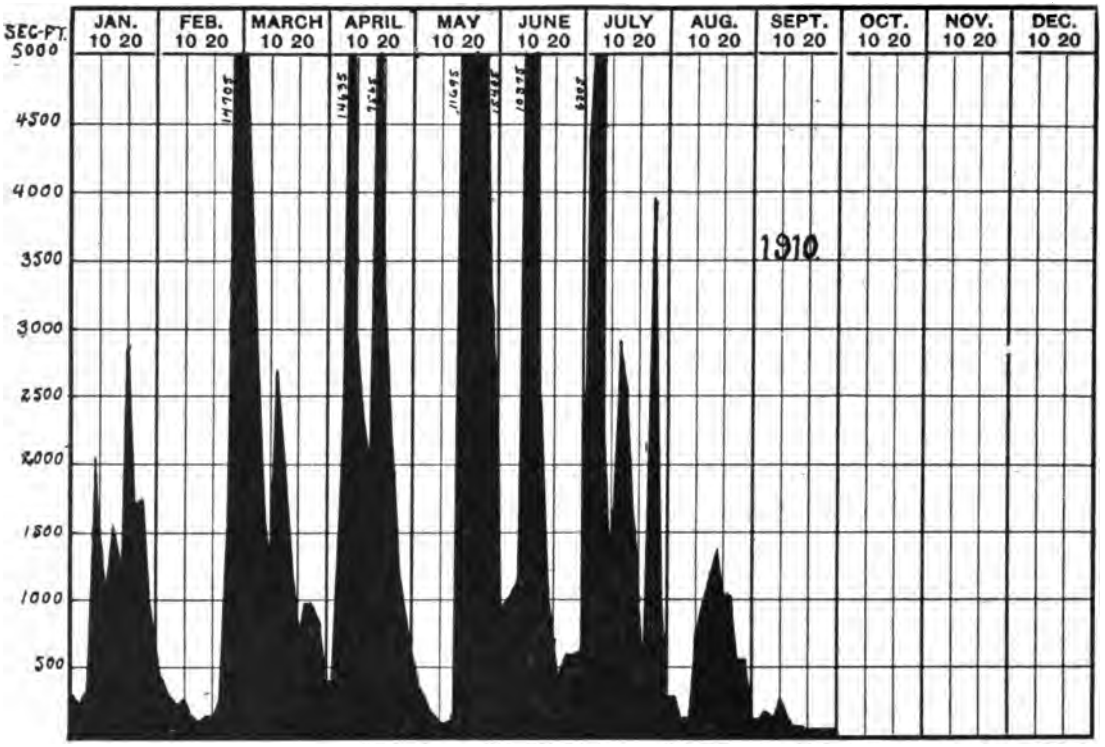

DISCHARGE OF LITTLE RED RIVER AT PANGBURN ARK. 1810.

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PLATE XXVI

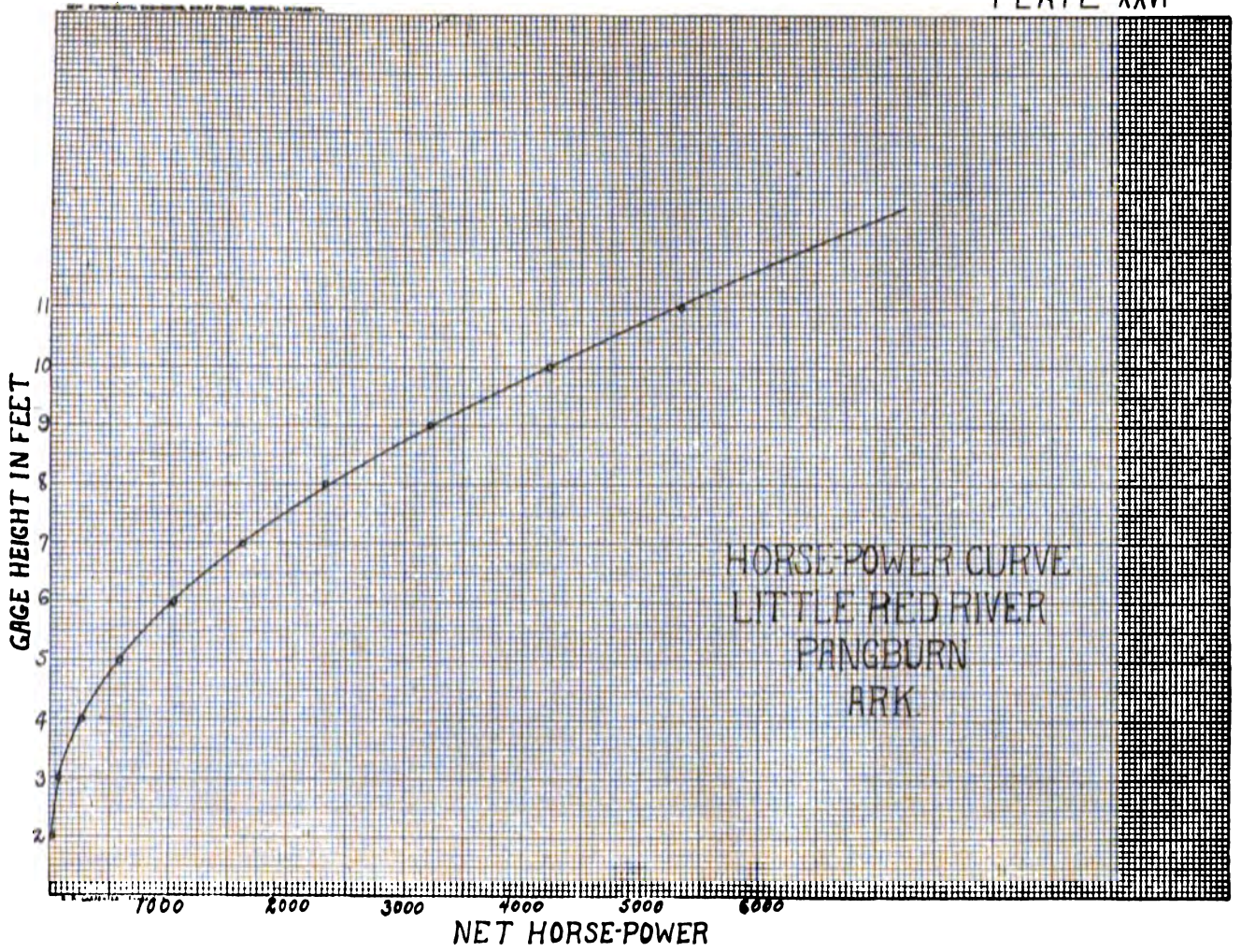

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PLATE XXVII

VALLEY OF BUFFALO FORK OF WHITE RIVER

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PLATE LXXVIII

BUFFALO FORK OF WHITE RIVER IN MARION COUNTY

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PLATE XXIX

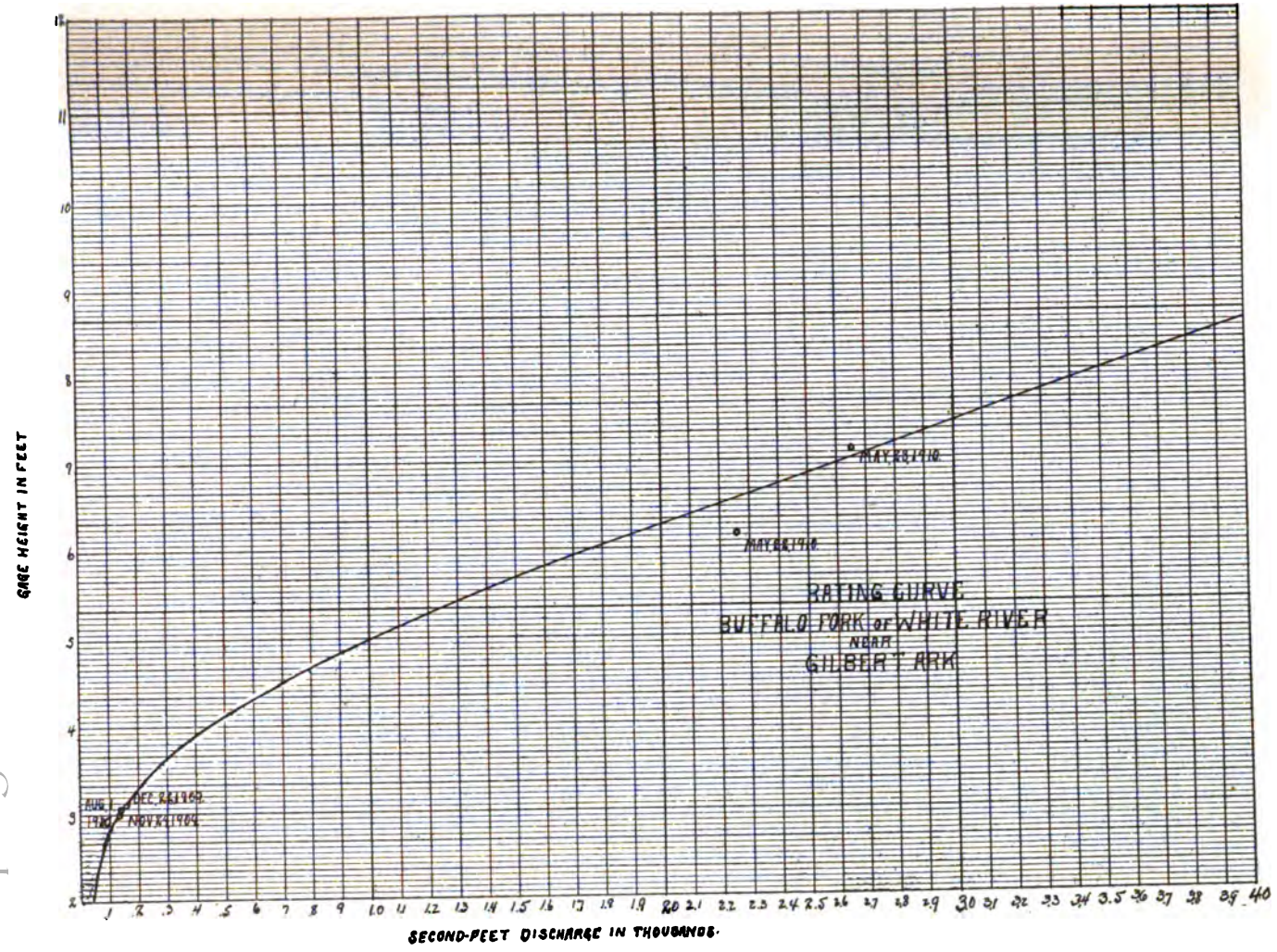

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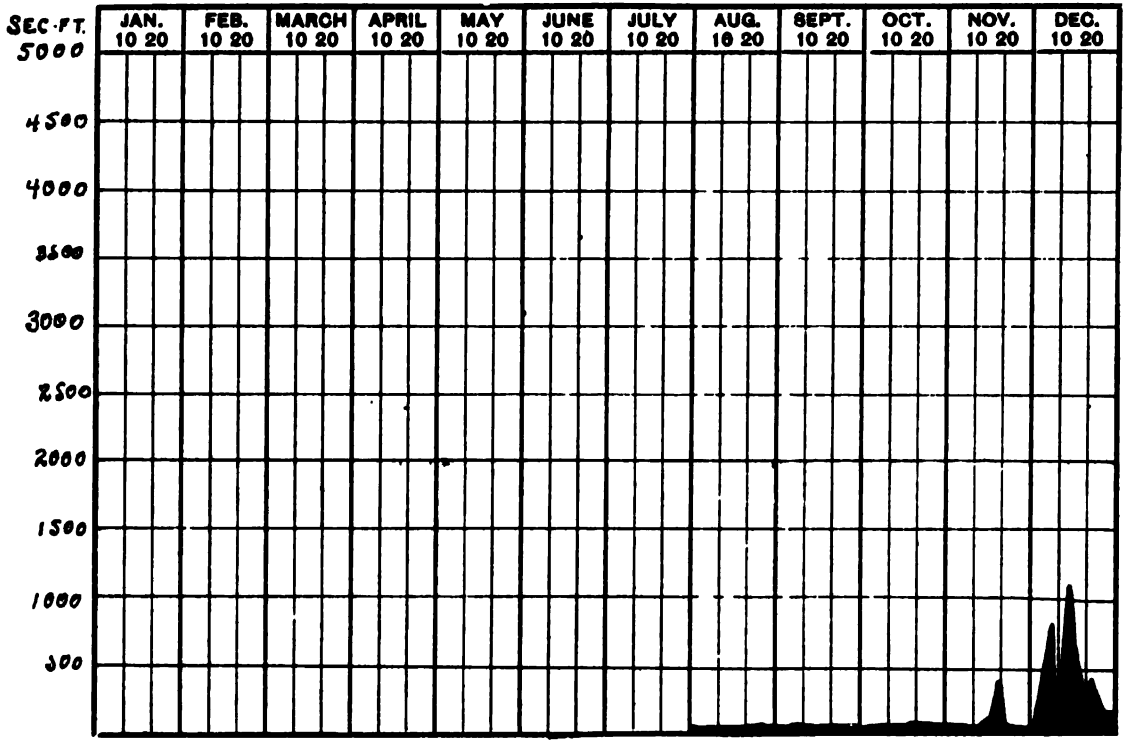
PLATE XXX



DISCHARGE OF BUFFALO FORK OF WHITE RIVER NEAR GILBERT ARK. 1908.

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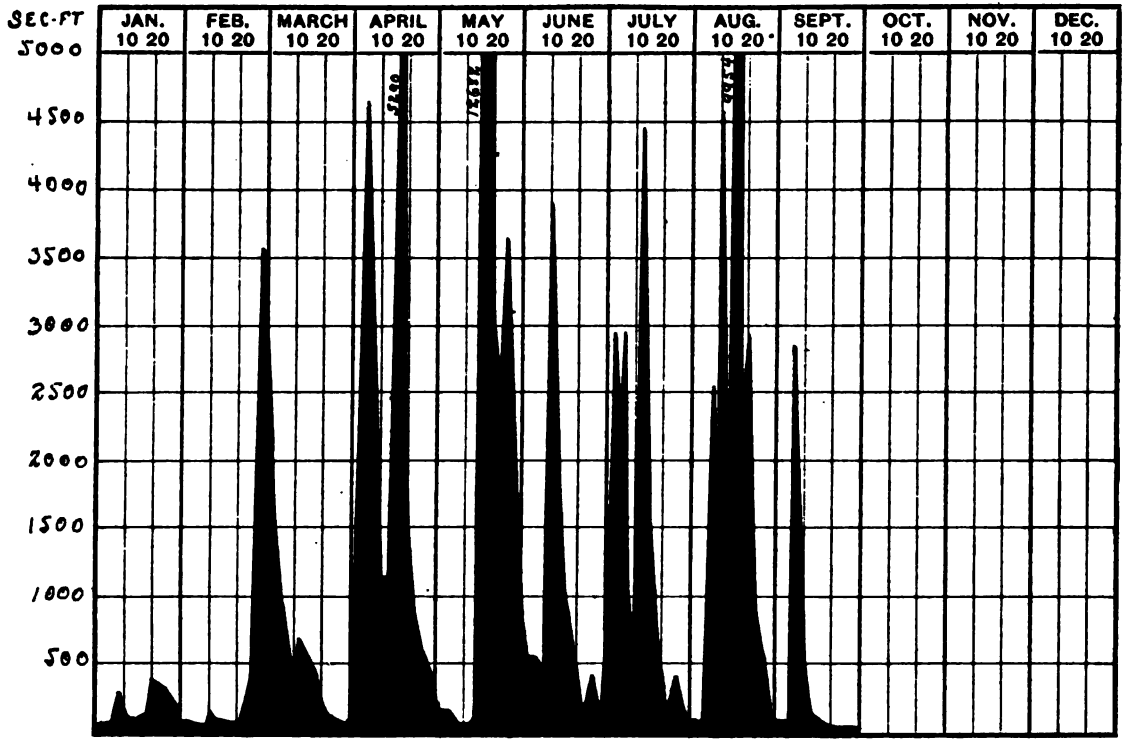
PLATE XXXI



DISCHARGE OF BUFFALO FORK OF WHITE RIVER NEAR GILBERT ARK. 1910

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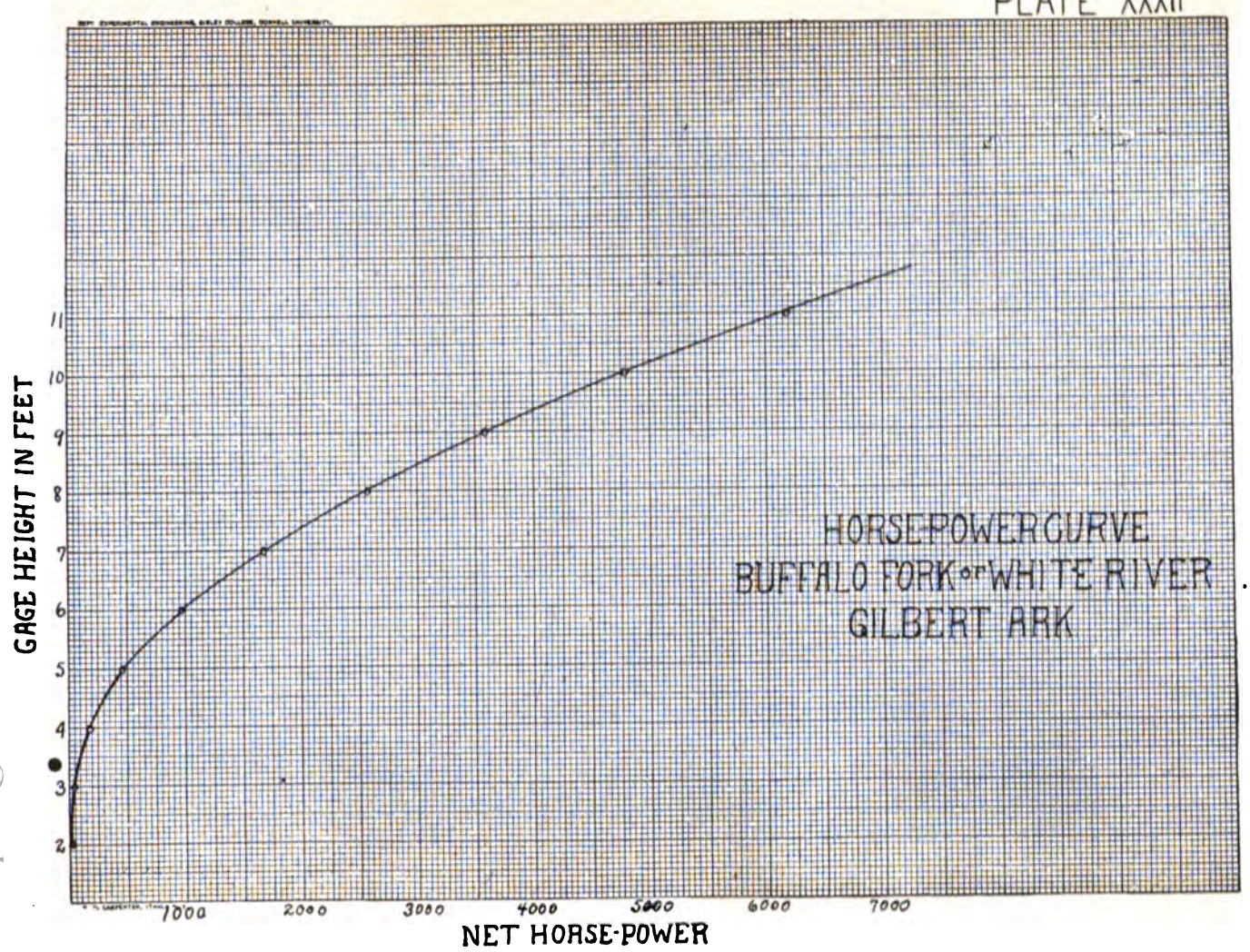
PLATE XXXII



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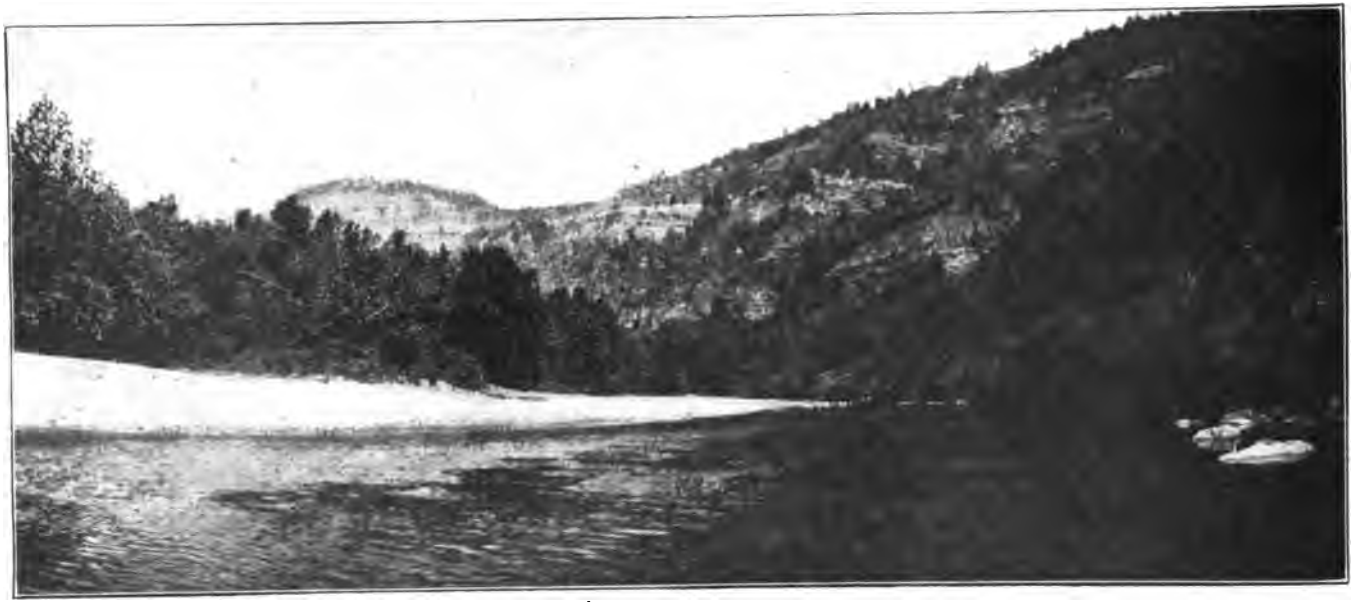

UPPER END OF SEVEN MILE BEND ON BUFFALO FORK OF WHITE RIVER

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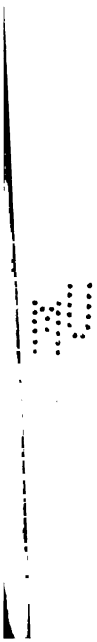

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